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John Kieling, Bureau Chief
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Santa Fe, NM 87505-6303

Subject: Submittal of the Plugging and Abandonment Summary Report for Wells and Boreholes for Fiscal Year 2015

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Plugging and Abandonment Summary Report for Wells and Boreholes for Fiscal Year 2015.

If you have any questions, please contact Ted Ball at (505) 665-3996 (tedball@lanl.gov) or Peter Maggiore at (505) 665-5025 (peter.maggiore@nnsa.doe.gov).

Sincerely,

Bruce Robinson, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

Peter Maggiore, Acting Chief of Staff
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BR/PM/TB:sm

Enclosures: Two hard copies with electronic files – Plugging and Abandonment Summary Report for Wells and Boreholes for Fiscal Year 2015 (EP2015-0186)

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January 2016
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Plugging and Abandonment Summary Report for Wells and Boreholes for Fiscal Year 2015

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

EP2015-0186

Plugging and Abandonment Summary Report for Wells and Boreholes for Fiscal Year 2015

January 2016

Responsible project manager:

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EXECUTIVE SUMMARY

This report details the methods Los Alamos National Laboratory (LANL or the Laboratory) used to plug and abandon wells MCOI-1; BCO-1; BCM-1; POTM-1; POTM-2; POTO-4A, B, C; POTO-5A, B; R-4 piezometers East and West; 16-P-0; 16-P-12A; I; NW-1; NE-1; NE-2; SE-1; MCWB-5; MCWB-6.2a; and TSWB-6. The wells were plugged and abandoned in accordance with direction from the New Mexico Environment Department (NMED), LANL-prepared work plans to plug and abandon wells and boreholes at LANL, and NMED's notice of approval with modifications to the plugging and abandonment work plans.

Plugging and abandonment activities occurred from July 16, 2015, to September 8, 2015. Before the wells were abandoned, all above- and belowground appurtenances were removed. Water-level measurements and total depths of the boreholes and wells were also verified using a water-level meter and/or video equipment before abandonment.

Wells BCO-1, BCM-1, 16-P-0, I, NW-1, NE-1, NE-2, SE-1, MCWB-5, MCWB-6.2a, and TSWB-6 were plugged and abandoned using a CME-75 HT hollow-stem auger (HSA) truck-mounted drill rig. Wells MCOI-1; POTM-1; POTM-2; POTO-4A, B, C; POTO-5A, B; R-4 piezometers East and West; and 16-P-12A were plugged and abandoned using a CME-75 track-mounted HSA drill rig. Portland Type I/II neat cement grout was used to plug and abandon the wells.

The wells were cement-grouted to approximately 2 ft below ground surface and a small concrete surface plug was installed near the ground surface. An aluminum survey marker was emplaced in the surface plug, and the surface completion was surveyed in accordance with Section IX.B.2.f of the Compliance Order on Consent.

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1.0 INTRODUCTION

This report summarizes field activities associated with the plugging and abandonment of wells and boreholes located in Los Alamos, New Mexico. The wells and boreholes included MCOI-1; BCO-1; BCM-1; POTM-1; POTM-2; POTM-3; POTO-4A, B, C; POTO-5A, B; R-4 piezometers East and West; boreholes 16-P-0 and 16-P-12A; boreholes I, NW-1, NE-1, NE-2 and SE-1; and alluvial wells MCWB-5, MCWB-6.2a, and TSWB-6 (Figure 1.0-1). The wells were plugged and abandoned in accordance with the New Mexico Environment Department– (NMED-) approved "Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015" (LANL 2015, 600295; NMED 2015, 600333); and the NMED-approved "Additional Work Plans for the Plugging and Abandonment of Wells for Fiscal Year 2015" (LANL 2015, 600484; NMED 2015, 600568).

2.0 PREABANDONMENT ACTIVITIES

The following activities were conducted before the subcontractor, TerranearPMC (TPMC), mobilized crews, material, and equipment on-site.

2.1 Removal of Appurtenances

All above- and belowground appurtenances were removed, including pumps, transducers, data loggers, control panels, and concrete surface pads, with the exception of those discussed in the abandonment sections below. Removal of appurtenances was performed by LANL personnel before mobilization to the well or borehole.

2.2 Downhole Video, Water-Level, and Total-Depth Measurements

Before TPMC received a notice to proceed with plugging and abandonment, LANL video-logged BCM-1, BCO-1, borehole 16-P-0, and borehole 16-P-12A to document downhole conditions (Appendix A). The remaining boreholes and wells comprising this work scope were not video logged because of their small diameters. Water-level and total-depth measurements were collected before plugging and abandonment of each borehole or well. Upon determination of presence of water in any of the boreholes or wells, TPMC immediately notified the LANL subcontractor technical representative (STR) to allow LANL personnel to make a determination of any actions required, including sampling or removal of water.

3.0 WELL AND BOREHOLE ABANDONMENT

The locations were plugged and abandoned in accordance with the LANL-approved subcontractor-prepared field implementation plan (FIP) using drilling equipment and crew provided by Geomechanics Southwest, Inc. The wells and boreholes were plugged and abandoned in the following order using a CME-75 hollow-stem auger (HSA) truck-mounted drill rig: alluvial wells MCWB-5, MCWB-6.2a, TSWB-6; boreholes I, NW-1, NE-1, NE-2, and SE-1; borehole 16-P-0; and boreholes BCO-1 and BCM-1. Once access restrictions because of the possible presence of the threatened and endangered Mexican spotted owl in upper Mortandad Canyon were lifted on September 1, a CME-75 track-mounted HSA drill rig was used to plug and abandon the remaining wells and boreholes in the following order: R-4 piezometers East and West; piezometer MCOI-1; borehole 16-P-12A; nested piezometers POTO-4A, B, C and POTO-5A, B; and alluvial wells POTM-2 and POTM-1. All polyethylene (poly) tubing used to tremie pressure grout piezometers and wells was left in place and abandoned with each piezometer, well, or borehole.

A Well Plugging Plan of Operations was submitted to and approved by the New Mexico Office of the State Engineer (NMOSE) for each well and borehole before the wells and boreholes were plugged and abandoned (Appendix B).

3.1 MCOI-1

3.1.1 Piezometer Construction

Piezometer MCOI-1 is located on a bench above the bottom of Mortandad Canyon in Technical Area 35 (TA-35). MCOI-1 was drilled as a corehole to a depth of 843.2 ft below ground surface (bgs) and completed as a 1-in. stainless-steel piezometer in January 2005, with a single screened interval from 815 to 825.5 ft bgs.

3.1.2 Plugging and Abandonment

Because of the small diameter of the MOCI-1 piezometer, neither video nor gamma logging was performed ahead of plugging and abandonment activities. Before plugging and abandonment activities occurred, LANL personnel sounded MCOI-1, and the piezometer was found to be dry to 822.85 ft below the top of casing. Plugging and abandonment activities for MCOI-1 took place between September 2 and 3, 2015.

A track-mounted CME-75 HSA rig was used to install 0.5-in.–inside diameter (I.D.) poly tubing to approximately 800 ft bgs, after which the piezometer was pressure grouted from total depth to ground surface with approximately 4.7 ft^3 of neat cement grout and the 1-in.-I.D. stainless-steel pipe was cut off below the ground surface. Subsequently, MCOI-1 was over-drilled with 4.25-in.-I.D./8-in.–outside diameter (O.D.) HSA flights to 20.5 ft bgs and grouted from total depth to 2 ft bgs with 7.4 ft^3 of neat cement grout using 1-in.-I.D. poly tubing to emplace the grout upward from the bottom of the borehole. Following abandonment, the top 2 ft of the borehole was plugged with concrete and an aluminum survey marker was embedded in the concrete.

Well construction details and final abandonment disposition for MCOI-1 are shown in Figure 3.1-1. The quantity of neat cement grout used during grouting is presented in Table 3.1-1.

3.2 BCO-1 and BCM-1

3.2.1 Well Construction

Groundwater monitoring wells BCO-1 and BCM-1 are located approximately 15 ft apart in Bayo Canyon on Los Alamos County property. According to well completion records, BCO-1 was drilled in November 1994 to a total depth of 70 ft bgs, with a 4-in.-I.D. well completed to a reported depth of 68 ft bgs. Recent video logging of BCO-1 recorded a 4-in.-I.D. polyvinyl chloride (PVC) well completed to a total depth of 69.7 ft bgs. According to well completion records, BCM-1 was drilled in October 1994 to a total depth of 94 ft bgs, with a 2-in.-I.D. well completed to a reported depth of 50 ft bgs. Recent video logging of BCM-1 recorded 2-in.-I.D. aluminum casing to a total depth of 67.8 ft bgs.

3.2.2 Plugging and Abandonment

Before plugging and abandonment activities occurred, water levels and total depths were measured in BCO-1 and BCM-1. Well BCO-1 was dry to total depth, and well BCM-1 was dry to total depth. Plugging and abandonment activities took place at BCO-1 and BCM-1 on July 28, 2015.

A truck-mounted HSA rig was used to install 1-in.-I.D. poly tubing to total depth inside each well. Each well was then pressure grouted through the poly tubing from total depth to 2 ft bgs with neat cement grout. Approximately 8 ft^3 and 2 ft^3 of neat cement grout, respectively, were used to fill the BCO-1 and BCM-1 casing strings from total depth to 2 ft bgs. Following pressure grouting of the wells, the steel protective casings were removed, at which time the casing strings separated below ground level. Well BCO-1 was then over-drilled with 6.25-in.-I.D./10-in.-O.D. HSA flights to 20 ft bgs, after which the borehole was sealed with approximately 11.4 ft^3 of neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs as the augers were removed. Well BCM-1 was then over-drilled with 3.25-in.-I.D./7-in.-O.D. HSA flights to 20 ft bgs and grouted in similar fashion as BCO-1. Approximately 5.3 ft^3 of neat cement grout was used to seal the BCM-1 borehole. The remaining grout-filled well casings were left in place below the ground surface to reduce waste. Following abandonment, the top 2 ft of each borehole was plugged with concrete, and an aluminum survey marker was embedded in the concrete plugs.

Well construction details and final abandonment disposition for BCO-1 and BCM-1 are shown in Figures 3.2-1 and 3.2-2. The quantity of neat cement grout used during grouting is presented in Table 3.1-1.

3.3 POTM-1, POTM-2, POTM-3, POTO-4A, B, C, and POTO-5A, B

3.3.1 Well and Piezometer Construction

Boreholes POTM-1, POTM-2, and POTM-3 and piezometers POTO-4 and POTO-5 were drilled and installed in 1991 in Potrillo Canyon, inside TA-36. POTM-1, POTM-2, and POTM-3 were drilled to 50, 54, and 52 ft bgs, respectively, with each location cased with 2-in.-I.D. aluminum pipe with welded end caps. POTO-4 was drilled to a total depth of 180 ft bgs and consisted of a cluster of three 2-in.-I.D. PVC piezometers screened at 154.0 to 164.0 ft bgs, 79.0 to 87.7 ft bgs, and 27.0 to 47.2 ft bgs. POTO-5 was drilled to a total depth of 77.1 ft bgs and consisted of two 2-in.-I.D. PVC piezometers screened at 57.5 to 67.5 ft bgs and 7 to 17 ft bgs.

3.3.2 Plugging and Abandonment

Before plugging and abandonment activities occurred, each of the wells and piezometer nests was checked for the presence of water. Well POTM-1 was dry to total depth, and well POTM-2 was dry to total depth. Well POTM-3 had been plugged and abandoned previously, with the grout monument located on land surface by LANL STR and TPMC personnel using a LANL global positioning system (GPS). Nested piezometer POTO-4A was dry to 47.2 ft bgs, POTO-4B was dry to 87.7 ft bgs, and in POTO-4C water was measured at 173.35 ft bgs (total depth of 174.2 ft bgs, 0.8 ft of water). Nested piezometer POTO-5A had depth to water of 77.05 ft bgs (total depth of 77.1 ft bgs, 0.05 ft of water) and in POTO-5B water was measured at 26.6 ft bgs (total depth of 27.2 ft bgs, 0.6 ft of water). No video or gamma logging was performed ahead of plugging and abandonment activities at these locations. Plugging and abandonment activities occurred at these locations from September 4 to 5, 2015.

A track-mounted HSA rig was used to install 1-in.-I.D. poly tubing to total depth in each well and piezometer nest to pressure grout all locations to surface before over-drilling activities began. Well POTM-1 was pressure grouted from total depth to 2 ft bgs with approximately 1.7 ft^3 of neat cement grout. Well POTM-2 was pressure grouted from total depth to 2 ft bgs using approximately 1.6 ft^3 of neat cement grout. Each piezometer casing comprising POTO-4A, B, C was pressure grouted from total depth to 2 ft bgs using approximately 8 ft^3 of neat cement grout for all three casing strings. The casing strings in POTO-5A, B were pressure grouted from total depth to 2 ft bgs using approximately 2.7 ft^3 of neat cement

grout for the two casing strings. Following pressure grouting of the piezometers and wells, the steel protective casings were removed, at which time the casing strings separated below ground level.

Following completion of pressure grouting, POTO-4A, B, C was over-drilled with 6.25-in.-I.D./10-in.-O.D. HSA flights to 20.5 ft bgs and then sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs using approximately 13.4 ft^3 of neat cement as the augers were removed. POTO-5A, B was then over-drilled with 6.25-in.-I.D./10-in.-O.D. HSA flights to 20.5 ft bgs and grouted in similar fashion as POTO-4A, B, C. Approximately 7.4 ft^3 of neat cement grout was used to seal the POTO-5A, B borehole. Subsequently, POTM-2 was over-drilled with 4.25-in.-I.D./8-in.-O.D. HSA to 20.5 ft bgs and grouted from total depth to 2 ft bgs using 7.4 ft^3 of neat cement grout as the augers were removed. After work at POTM-2 was completed, the tracked HSA rig was moved up Potrillo Canyon to POTM-1. Well POTM-1 was over-drilled with 4.25-in.-I.D./8-in.-O.D. using HSA flights to 20.5 ft bgs and grouted from total depth to 2 ft bgs using 9.4 ft^3 of neat cement grout as the augers were removed. The remaining grout-filled piezometer and well casings at each location were left in place below the ground surface to reduce waste. After plugging and abandonment activities were completed at the four locations, the top 2 ft of each borehole was plugged with concrete, and aluminum survey markers were embedded in the concrete plugs.

Construction details and final abandonment disposition for POTM-1; POTM-2; POTO-4A, B, C; and POTO-5A, B are shown in Figures 3.3-1, 3.3-2, 3.3-3, and 3.3-4, respectively. The quantity of neat cement grout used during grouting is presented in Table 3.1-1.

3.4 R-4 Piezometers East and West

3.4.1 Piezometer Construction

The R-4 piezometers East and West were completed in 2004 in a 233-ft-deep corehole installed on the R-4 pad in Pueblo Canyon. Each piezometer consists of 2-in.-diameter flush-threaded PVC pipe. R-4 piezometers East and West were screened at 221 to 231 ft bgs and 115 to 125 ft bgs, respectively.

3.4.2 Plugging and Abandonment

Before plugging and abandonment activities occurred, water levels and total depths were measured in R-4 piezometers East and West. The East piezometer was dry to total depth, and the West piezometer was dry to 124.95 ft bgs. Plugging and abandonment activities took place on September 2, 2015.

A track-mounted HSA rig was used to install 1-in.-I.D. poly tubing inside each casing string to total depth. Each casing string was then pressure grouted through the poly tubing from total depth to 2 ft bgs with neat cement grout. Approximately 5.9 ft^3 of neat cement grout was used to pressure grout the East piezometer, and approximately 3.3 ft^3 of neat cement grout was used in pressure grouting the West piezometer. Following pressure grouting of the piezometers, the steel protective casing was removed, at which time the casing strings separated below ground level. Subsequently, R-4 piezometers East and West were over-drilled with 6.25-in.-I.D./10-in.-O.D. HSA flights to 20.5 ft bgs, and the borehole was sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. Approximately 12 ft^3 of grout was used to seal the borehole. The remaining grout-filled piezometer casing strings were left in place below the ground surface to reduce waste. Following abandonment, the top 2 ft of the borehole was plugged with concrete, and an aluminum survey marker was embedded in the concrete plug.

Piezometer construction details and final abandonment disposition for R-4 piezometers East and West are shown in Figure 3.4-1. The quantity of neat cement grout used during grouting is presented in Table 3.1-1.

3.5 16-P-0 and 16-P-12A

3.5.1 Well Construction

Boreholes 16-P-0 and 16-P-12A were installed in 1987 at TA-16 on the east side of the burning grounds. Each borehole was completed with 2-in.-diameter aluminum casing with bottom caps. Borehole 16-P-0 was completed to a reported depth of 135 ft bgs. Recent video logging of borehole 16-P-0 was recorded to a total depth of 119.9 ft bgs with water documented within the casing at 119.3 ft bgs. Borehole 16-P-12A was completed to a reported depth of 200 ft bgs. Recent video logging of borehole 16-P-12A was recorded to a total depth of 175.4 ft bgs with water documented within the casing at 169.6 ft bgs.

3.5.2 Plugging and Abandonment

Before plugging and abandonment activities occurred at boreholes 16-P-0 and 16-P-12A, water levels and total depth measurements were collected. In borehole 16-P-0, water was measured at 118.6 ft bgs and total depth was measured at 119 ft bgs (0.4 ft of water). In borehole 16-P-12A, water was measured at 170.1 ft bgs and total depth measured at 175 ft bgs (4.9 ft of water). Plugging and abandonment activities took place at boreholes 16-P-0 and 16-P-12A on July 23 and September 4, 2015, respectively.

A truck-mounted HSA rig was used for plugging and abandoning activities at 16-P-0, and a track-mounted HSA rig was used to plug and abandon borehole 16-P-12A. At each location, 1-in.-I.D. poly tubing was installed inside the aluminum casing strings to total depth and each casing string was then pressure grouted through the poly tubing from total depth to 2 ft bgs with neat cement grout. Approximately 4 ft^3 and 4.7 ft^3, respectively, was used to pressure grout the 16-P-0 and 16-P-12A casing strings. Following pressure grouting of the wells, the steel protective casings were removed, at which time the casing strings separated below ground level. Borehole 16-P-0 was over-drilled to 20.25 ft bgs using 3.25-in.-I.D./7-in.-O.D. HSA flights, and the borehole was sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs using approximately 5.3 ft^3 of neat cement grout. Borehole 16-P-12A was over-drilled to 20.5 ft bgs using 4.25-in.-I.D./8-in.-O.D. HSA flights and the borehole was sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. Approximately 7.4 ft^3 of grout was used to seal borehole 16-P-12A. The remaining grout-filled well casings at each location were left in place below the ground surface to reduce waste. Following abandonment, the top 2 ft of each boreholes was plugged with concrete and aluminum survey markers were embedded in the concrete plugs.

Well construction details and abandonment disposition for boreholes 16-P-0 and 16-P-12A are shown in Figures 3.5-1 and 3.5-2. The quantity of neat cement grout used during grouting is presented in Table 3.1-1.

3.6 Wells I, NW-1, NE-1, NE-2 and SE-1

3.6.1 Well Construction

Wells I, NW-1, NE-1, NE-2, and SE-1 were installed as air-injection test holes in 1964 and 1965 in TA-52, which is located near Material Disposal Area (MDA) C. Wells I, NW-1, NE-2 and SE-1 are 5-in.-diameter

boreholes completed to 97 ft bgs, with each having a surface completion of 6-in.-I.D. steel casing cemented into the top of the tuff. Location NE-1 was completed in a 4-in.-diameter borehole to a depth of 295 ft bgs and was completed at the surface with an 18-in.-I.D. steel casing grounded into the top of the tuff. In each case, the steel surface casings are filled with concrete.

Each well has steel riser pipes protruding through the steel surface casing. Wells I, NW-1, NE-2, and SE-1 have 0.75-in.-I.D. and 2-in.-I.D. galvanized wellhead pipe fittings connected to two plastic tubes extending downward from surface completions into 10-ft-thick injection zones containing pea-sized gravel from 87 to 97 ft bgs. Borehole NE-1 has 1.5-in.-I.D. and two 0.75-in.-I.D. galvanized wellhead pipe fittings connected to plastic tubes extending downward to injection zones at approximately 272 to 291 ft bgs and 160 to 170 ft bgs. The bottom 10 ft of each plastic tube consists of perforated material. Each injection-zone interval was completed with 10 ft of pea-sized gravel and isolated with a cement plug.

3.6.2 Plugging and Abandonment

Before plugging and abandonment activities occurred at wells I, NW-1, NE-2, SE-1, and NE-1, water level and total depth measurements were collected. Because these wells are located near MDA C, the LANL Radiological Protection Group determined a radiological control technician (RCT) should be present when the wells were opened to survey for the presence of radiological and tritium hazards. When 0.75-in.-I.D. pipe fittings were opened at the surface for each location, each pipe was found to be blocked off at 2 ft bgs. No tritium or radiological contamination was present on sounding tape. Before total depths in remaining tubing depth intervals were measured, an RCT monitored for tritium when the wellhead fittings were opened. Initial tritium monitoring at wells NW-1 and SE-1 showed tritium values ranging from 50 µCi/m^3 to 60 µCi/m^3, exceeding the RP-1 standard of 20 µCi/m^3. Tritium levels diminished to 10 µCi/m^3 or fewer µCi/m^3within 8 min, and the RCT allowed the work crew to proceed with plugging and abandonment activities. Additionally, the sounding tape was surveyed for fixed alpha- and beta-radiological contamination upon retrieval from each well, with all survey results negative. The total depth for the 1.5-in.-I.D. tubing in each well was as follows: 76.2 ft bgs at well I; 77.2 ft bgs at well NW-1; 77.3 ft bgs at well NE-2; and 77.7 ft bgs at well SE-1. At well NE-1, the measured total depth for the 1.5-in. tubing was 284.2 ft bgs. Plugging and abandonment activities took place at wells I, NW-1, NE-2, SE-1, and NE-1 between July 17 and July 22, 2015.

A truck-mounted HSA rig was used to install 1-in.-I.D. poly tubing to total depth in each well to pressure grout all locations before the surface casings were removed. Wells I, NW-1, NE-2, and SE-1 were each pressure grouted from total depth to 2 ft bgs with approximately 2.8 ft^3 of neat cement grout at each location. Well NE-1 was pressure grouted from total depth to 2 ft bgs with approximately 4 ft^3 of neat cement grout.

After pressure grouting was completed at the five wells, 8.25-in.-I.D./12-in.-O.D. HSA rig were used to over-drill the 6-in.-I.D./6.5-in.-O.D. steel surface casing down to 3 ft bgs at wells I, NW-1, NE-2, and SE-1. The surface casings were then removed using a nylon rigging strap attached to the HSA rig's main winch line. After the surface casings were removed, the 0.75-in.-I.D. and 2-in.-I.D. poly air lines were observed to be set in tuff, with no concrete visible below where the bottom of the steel surface casings were set. In each of the wells, the 0.75-in.-I.D. plastic pipes were blocked. In well I, the 0.75-in. plastic pipe was blocked at 5.5 ft bgs, in well NW-1 it was blocked at 3 ft bgs, in well NE-2 it was blocked at 4.5 ft bgs, and in well SE-1 it was blocked at 4.5 ft bgs. The 2-in.-I.D. plastic pipes exposed at each location were found to be filled with grout. Given the lack of concrete below 3 ft bgs, wells I, NW-1, NE-2, and SE-1 were over-drilled from 3 to 20 ft bgs using 6.25-in.-I.D./10-in.-O.D. HSA flights, and the boreholes were sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. The grout-filled plastic pipes were removed during over-drilling to 20 ft bgs at each location. The following approximate

grout volumes were used to seal the boreholes: 16 ft^3 at well I, 13.4 ft^3 at NW-1, 16 ft^3 at NE-2, and 16 ft^3 at SE-1.

After the NW-1 borehole was sealed, the 18-in. surface casing at well NE-1 was removed from the ground using a nylon rigging strap attached to the HSA rig's main winch line. After the surface casing was removed, the 1.5-in.-I.D. and two 0.75-in.-I.D. poly air lines were observed to be placed immediately adjacent to each other, set in tuff, with no cement observed below where the bottom of the steel surface casing had been placed approximately 2 ft bgs. The two 0.75-in.-I.D. air lines were plugged at approximately 2 ft bgs, near the depth documented when initial total depths were measured, and the 1.5-in. plastic tubing was full of grout. Given the lack of cement below 2 ft bgs, well NE-1 was over-drilled from 2 ft bgs to 20 ft bgs. The three plastic tubing sections were bundled closely together, so 3.25-in.-I.D./7-in.-O.D. HSA flights were used to over-drill this well. The grout-filled plastic pipes were removed during over-drilling to 20 ft bgs. The borehole was sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs using approximately 10.7 ft^3 of grout.

After plugging and abandonment activities at I, NW-1, NE-2, SE-1, and NE-1 were completed, the top 2 ft of each borehole was plugged with concrete and aluminum survey markers were embedded in the concrete surface.

Borehole construction details and the abandonment disposition for boreholes I, NW-1, NE-1, SE-1, and NE-2 are shown in Figures 3.6-1, 3.6-2, 3.6-3, 3.6-4, and 3.6-5. The quantity of neat cement used during grouting is presented in Table 3.1-1.

3.7 MCWB-5, MCWB-6.2a, and TSWB-6

3.7.1 Well Construction

Alluvial wells MCWB-5, MCWB-6.2a, and TSWB-6 were installed in Mortandad and Ten Site Canyons as part of a water balance study in 1994. Each of these alluvial wells is reported to be completed with 2-in.-I.D. PVC casing and well screen to depths no greater than 40 ft bgs.

3.7.2 Plugging and Abandonment

Before plugging and abandonment activities occurred, water levels and total depths were measured in MCWB-5, MCWB-6.2a, and TSWB-6. Well MCWB-5 was dry to total depth, well MCWB-6.2a was dry to total depth, and well TSWB-6 was dry to total depth. Two of these wells, MCWB-6.2a and TSWB-6, were found to consist of 2.75-in.-I.D. PVC (3-in. schedule 80), and well MCWB-5 was completed with 2-in.-I.D. PVC. Plugging and abandonment activities took place at these three wells from July 20 to July 21, 2015.

A truck-mounted HSA rig was used to install 1-in.-I.D. poly tubing within MCWB-5, MCWB-6.2a, and TSWB-6. Each well was then pressure grouted through the poly tubing from total depth to the top of each well casing with neat cement grout. A total of 2 ft^3 of neat cement grout was used to fill the MCWB-5 casing string, 2.9 ft^3 of neat cement grout was used to fill the MCWB-6.2a casing string, and 3.3 ft^3 of neat cement grout was used to fill the TSWB-6 casing string. After the wells were pressure grouted, the steel protective casings were removed, at which time the casing strings separated below ground level. After pressure grouting, MCWB-5 was over-drilled to 20 ft bgs with 3.25-in.-I.D./7-in.-O.D. HSA flights and the borehole sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. Approximately 6.7 ft^3 of neat cement grout was used to seal borehole MCWB-5. Borehole MCWB-6.2a was over-drilled to 20 ft bgs with 6.25-in.-I.D./10-in.-O.D. HSA flights and the borehole sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. Approximately 13.4 ft^3 of grout was used to seal borehole MCWB-6.2a. Following work performed at

MCWB-6.2a, well TSWB-6 was over-drilled with 6.25-in.-I.D./10-in.-O.D. HSA flights to 20 ft bgs, after which the borehole was sealed with neat cement grout pumped through 1-in. poly tubing from total depth upward to 2 ft bgs. Approximately 13.4 ft^3 of grout was used to seal the TSWB-6 borehole. The remaining grout-filled well casings at each location were left in place below the ground surface to reduce waste. Following abandonment work at all three locations, the top 2 ft of each borehole was capped with concrete, and aluminum survey markers were embedded in the concrete caps.

Well construction details and the abandonment disposition for MCWB-5, MCWB-6.2a, and TSWB-6 are shown on Figures 3.7-1, 3.7-2, and 3.7-3, respectively. The quantity of neat cement used during grouting is presented in Table 3.1-1.

3.8 Water Sampling

Water-level measurements before plugging and abandonment activities indicated water was present at the following locations: POTO-4C (0.8 ft of water), POTO-5A (0.05 ft), POTO-5B (0.6 ft) and 16-P-0 (0.4 ft). Given the minimal quantity of water at these locations, samples were not collected.

Water was also measured in boreholes 16-P-12A (4.9 ft of water). However, because 16-P-12A was a neutron access tube with no screened interval installed to measure subsurface moisture conditions and did not encounter a water-bearing zone, NMED informed LANL that sample collection was not required at this well.

3.9 Surface Completions

The wells and boreholes were grouted with Portland Type I/II neat cement to 2 ft bgs. Subsequently, the top 2 ft of each location was filled with concrete and mounded above existing grade with an aluminum survey marker embedded in the concrete plug.

4.0 GEODETIC SURVEY

Geodetic surveys were conducted on the surface completions (Table 4.0-1) with a Trimble RTK GPS. The survey data collected conform to LANL Information Architecture project standards IA-CB02, “GIS Horizontal Spatial Reference System,” and IA-D802, “Geospatial Positioning Accuracy Standard for A/E/C and Facility Management.” All coordinates are expressed relative to the New Mexico State Plane Coordinate System Central Zone (NAD 83); elevation is expressed relative to feet above mean sea level (amsl) using the National Geodetic Vertical Datum of 1929. The survey point was the aluminum pin placed in the concrete plug.

5.0 WASTE MANAGEMENT

Waste generated from the plugging and abandonment project included drill cuttings, surface casings, and contact waste.

All waste streams produced during plugging and abandonment activities were sampled in accordance with “Waste Characterization Strategy Form for Plug and Abandonment (P&A) of LANL Wells” and subsequent amendments (LANL 2011, 205839; LANL 2012, 209732; LANL 2013, 238457).

All wastes will be managed in accordance with the waste characterization strategy form (WCSF) and EP-DIR-SOP-10012, Characterization of Environmental Programs Waste. Characterization of contact

waste will be based upon acceptable knowledge from historical site data per LANL Procedure P930-1, LANL Waste Acceptance Criteria.

6.0 DEVIATIONS FROM PLANNED ACTIVITIES

TA-52 wells I, NW-1, NE-2, SE-1, and NE-1 were planned as if the plastic tubes at each location would be pressure grouted with neat cement through poly tubing from bottom of each zone to ground surface. Following grouting of the plastic tubes, the concrete-filled steel surface casings were to be cut off at ground surface and capped with concrete. However, when the smaller-diameter pipe fittings were opened at the surface, each of the tubes connected to the pipe fittings was blocked approximately 2 ft below ground surface. Additionally, the drill crew was unable to cut the concrete-filled surface casings at ground surface, but the drill crew was able to use a nylon rigging strap connected to the main winch line on the HSA rig to remove the surface casings, which were cemented into the tuff approximately 2 ft below ground surface. Each of the smaller-diameter tubes exposed after surface casings were removed from the wells were blocked below the ground surface and thus could not be pressure grouted. To ensure each well location was sealed, the wells were over-drilled to 20 ft bgs with HSA flights and the boreholes grouted with neat cement through 1-in.-I.D. poly tubing from total depth to 2 ft bgs. These locations were then capped with concrete and aluminum survey markers were placed in the concrete surface.

Well POTM-3 was planned to be plugged and abandoned during this phase of work. However, when an attempt was made to locate POTM-3 using LANL-provided survey coordinates, only a slightly mounded cement surface plug was found, and LANL determined that POTM-3 had been plugged and abandoned previously.

Wells 33-01230, 33-01231, and 33-01232 were included in the work plan submitted to NMED in March 2015 for plugging in fiscal year 2015 based on information available at the time the report was prepared (LANL 2015, 600295). However, field reconnaissance conducted by LANL personnel after the work plan had been submitted to NMED found no evidence of these wells in the field. They are assumed to have been plugged and abandoned.

Wells 49-2-150-1 and 49-2-150-2 were also included in the 2015 work plan submitted to NMED. Field reconnaissance conducted by LANL after the work plan was submitted found only one of these wells (49-2-150-2). It was decided that a more extensive search for penetrations inside the nuclear environmental site (NES) at TA-49 should be conducted before any wells were plugged because of the costs associated with preparing for field work the NES.

7.0 SUMMARY

Plugging and abandonment activities occurred from July 16, 2015, to September 8, 2015. Before the wells were abandoned, all above- and belowground appurtenances were removed. Before abandonment, water-level measurements and total depths of the boreholes and wells were verified using a water-level meter and/or video equipment. All above- and belowground appurtenances were also removed. Plugging and abandonments were completed with a CME-75 HT truck-mounted auger rig and/or a CME-75 track-mounted rig.

Wells BCO-1, BCM-1, 16-P-0, I, NW-1, NE-1, NE-2, SE-1, MCWB-5, MCWB-6.2a, and TSWB-6 were plugged and abandoned using a CME-75 HT HSA truck-mounted drill rig. Wells MCOI-1; POTM-1; POTM-2; POTO-4A, B, C; POTO-5A, B; R-4 piezometers East and West; and 16-P-12A were plugged and abandoned using a CME-75 track-mounted HSA drill rig. Portland Type I/II neat cement grout was used to plug and abandon the wells.

The wells were cement-grouted to approximately 2 ft below ground surface and a small concrete surface plug was installed near the ground surface. An aluminum survey marker was emplaced in the surface plug, and the surface completion was surveyed in accordance with Section IX.B.2.f of the Consent Order.

8.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the ESH Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), August 16, 2011. "Waste Characterization Strategy Form for Plug and Abandonment (P&A) of LANL Wells," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2011, 205839)

LANL (Los Alamos National Laboratory), January 2012. "Amendment #1 to the Waste Characterization Strategy Form for Plug and Abandonment (P&A) of LANL Wells," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2012, 209732)

LANL (Los Alamos National Laboratory), March 21, 2013. "Amendment #2 to the Waste Characterization Strategy Form for Plug and Abandonment (P&A) of LANL Wells," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2013, 238457)

LANL (Los Alamos National Laboratory), March 2015. "Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015," Los Alamos National Laboratory document LA-UR-15-20937, Los Alamos, New Mexico. (LANL 2015, 600295)

LANL (Los Alamos National Laboratory), June 2015. "Additional Work Plans for the Plugging and Abandonment of Wells for Fiscal Year 2015," Los Alamos National Laboratory document LA-UR-15-23762, Los Alamos, New Mexico. (LANL 2015, 600484)

NMED (New Mexico Environment Department), March 31, 2015. "Approval with Modification, Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015," New Mexico Environment Department letter to P. Maggiore (DOE-EM-LA) and M. Brandt (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2015, 600333)

NMED (New Mexico Environment Department), July 15, 2015. "Approval, Additional Work Plans for the Plugging and Abandonment of Wells for Fiscal Year 2015," New Mexico Environment Department letter to C. Gelles (DOE-NA-LA) and M.T. Brandt (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2015, 600568)

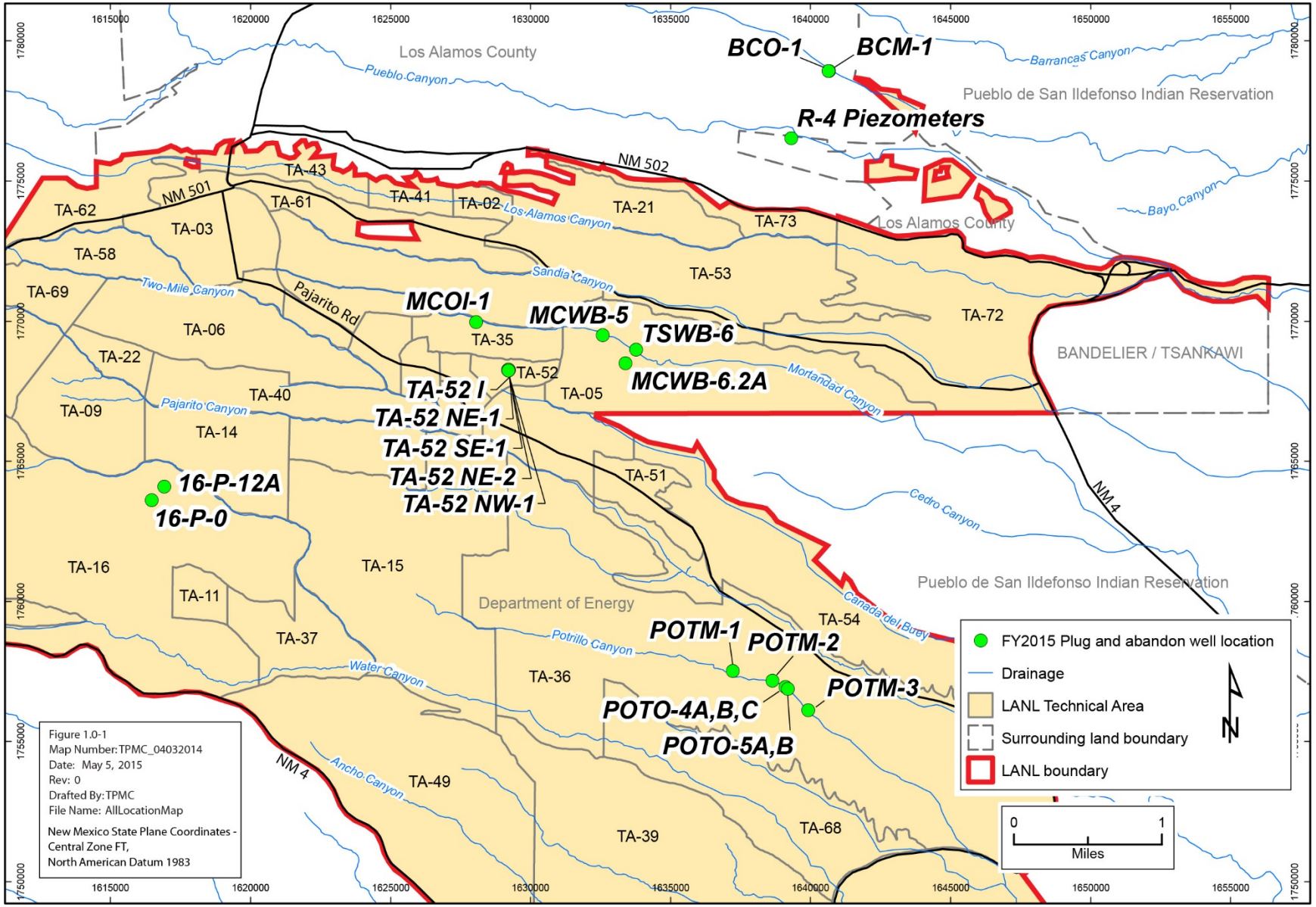

Figure 1.0-1 General locations of FY2015 P&A wells

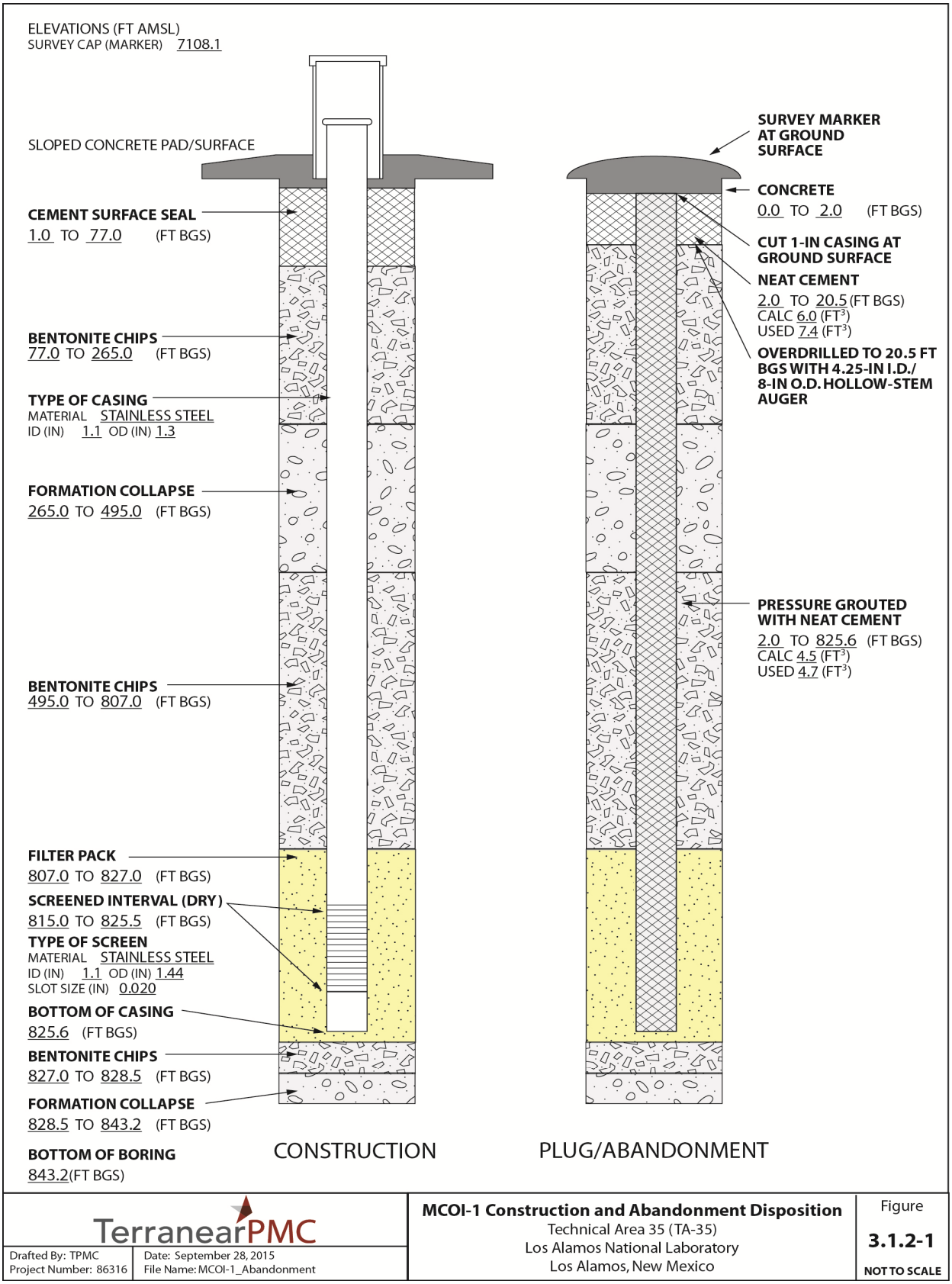

Figure 3.1-1 MCOI-1 construction and abandonment disposition

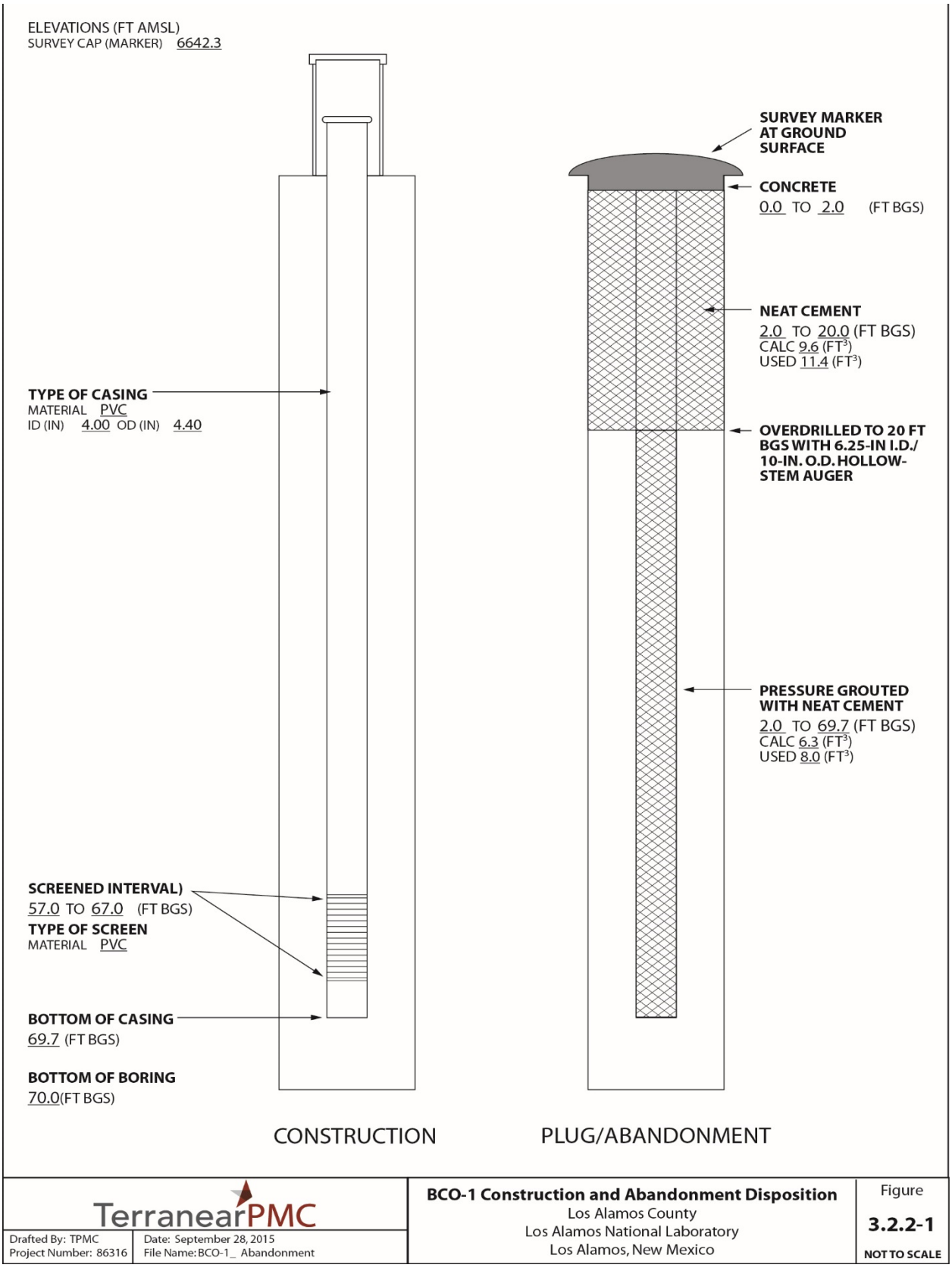

Figure 3.2-1 BCO-1 construction and abandonment disposition

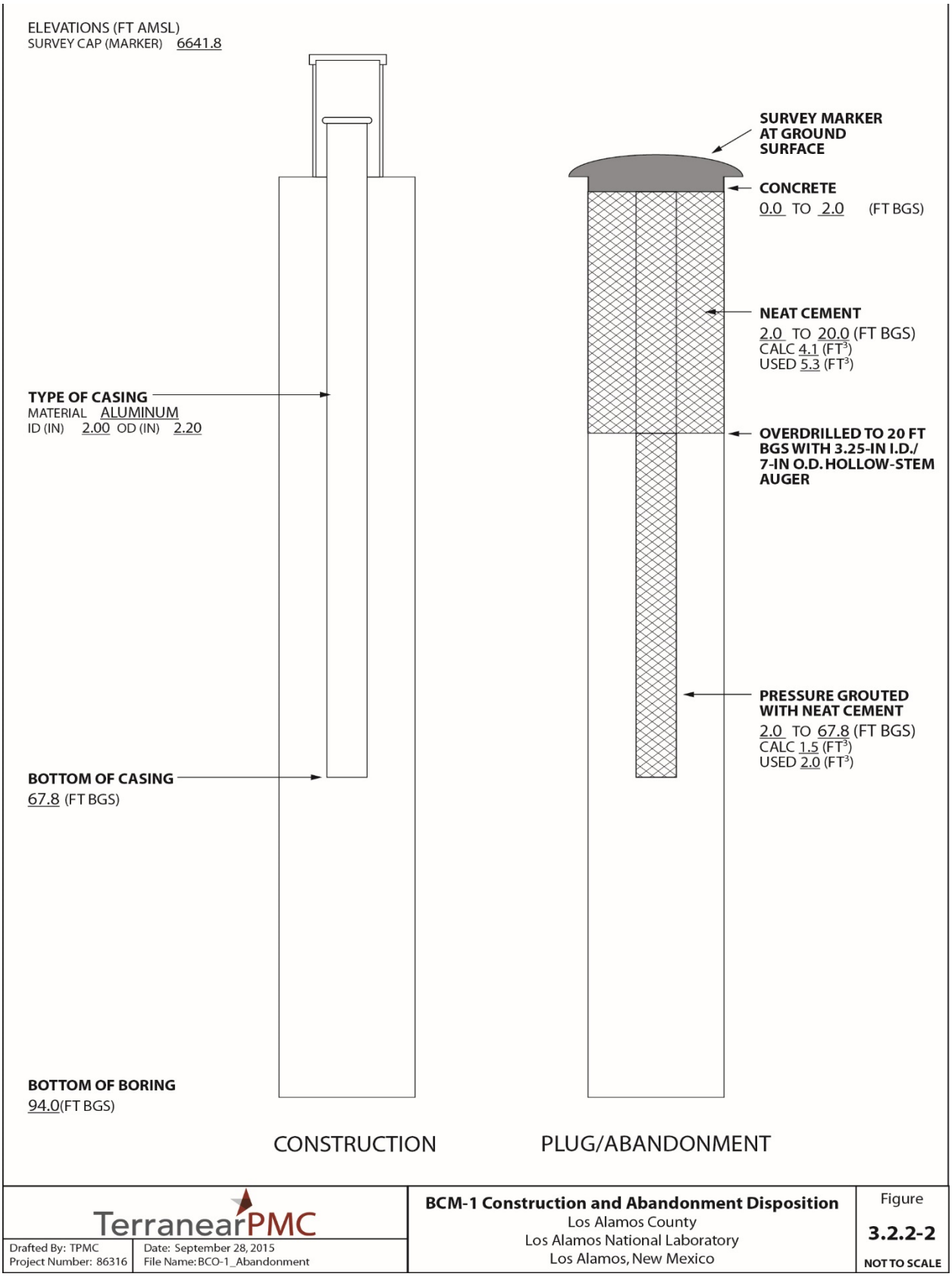

Figure 3.2-2 BCM-1 construction and abandonment disposition

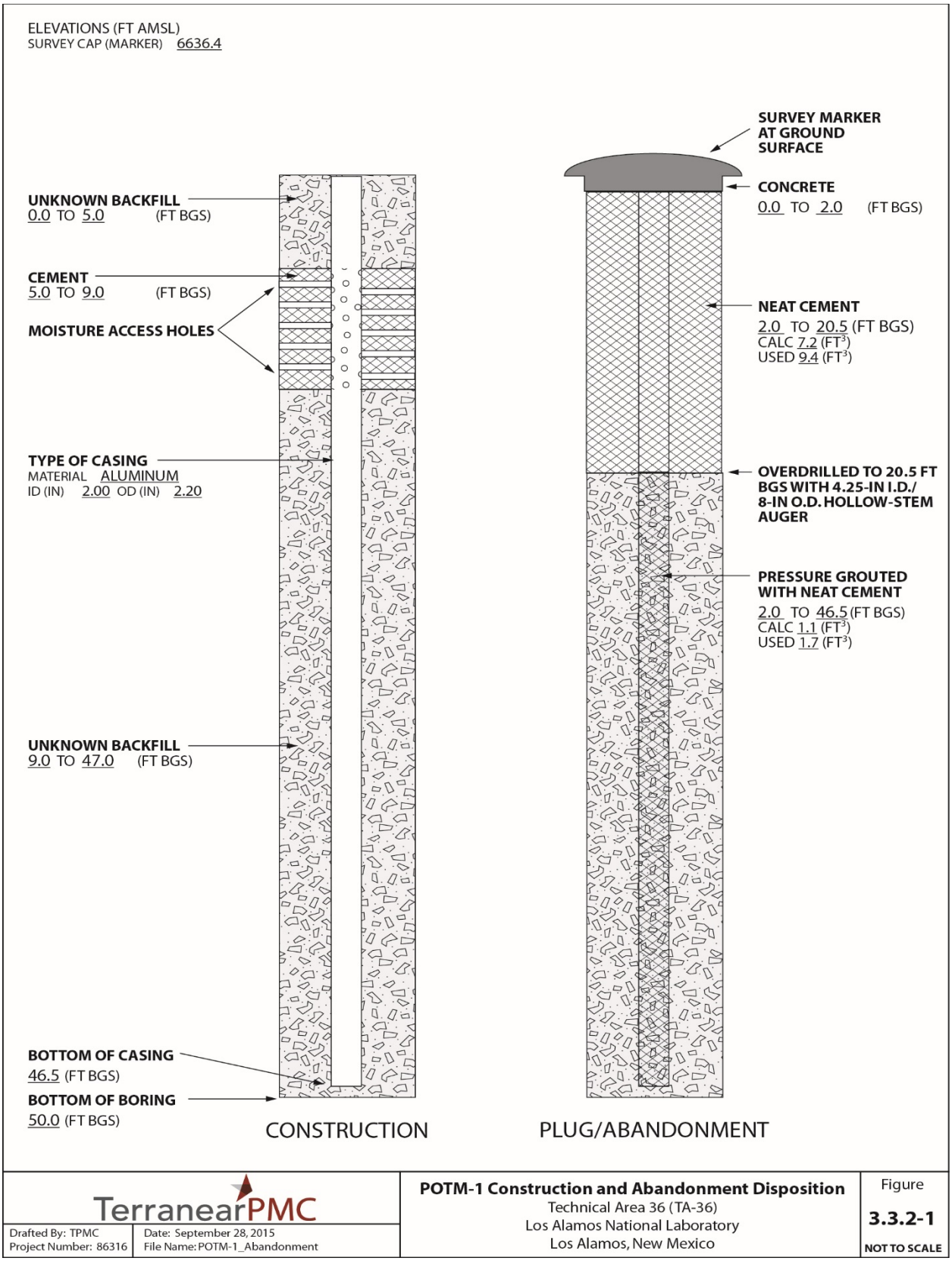

Figure 3.3-1 POTM-1 construction and abandonment disposition

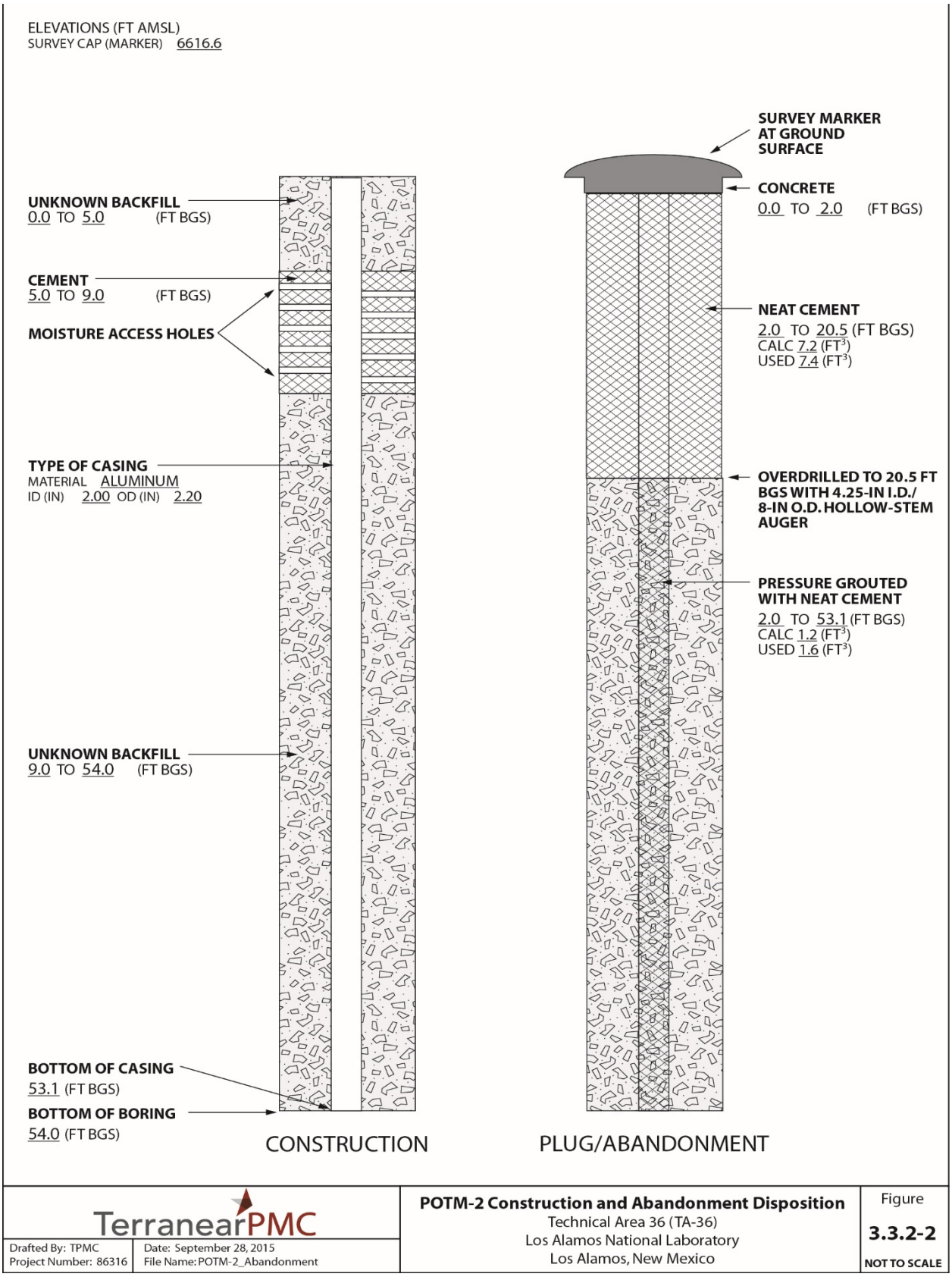

Figure 3.3-2 POTM-2 construction and abandonment disposition

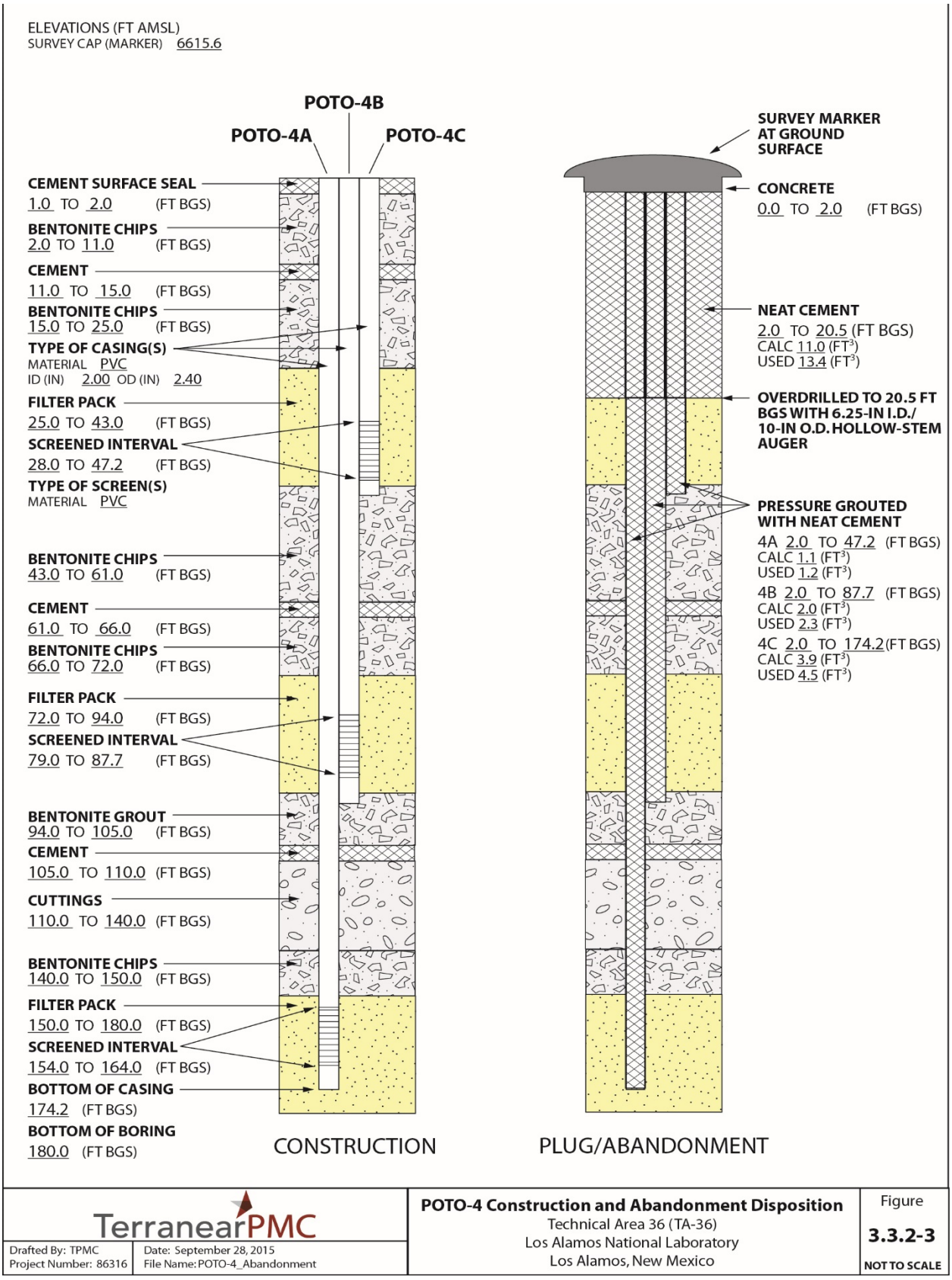

Figure 3.3-3 POTO-4A, B, C construction and abandonment disposition

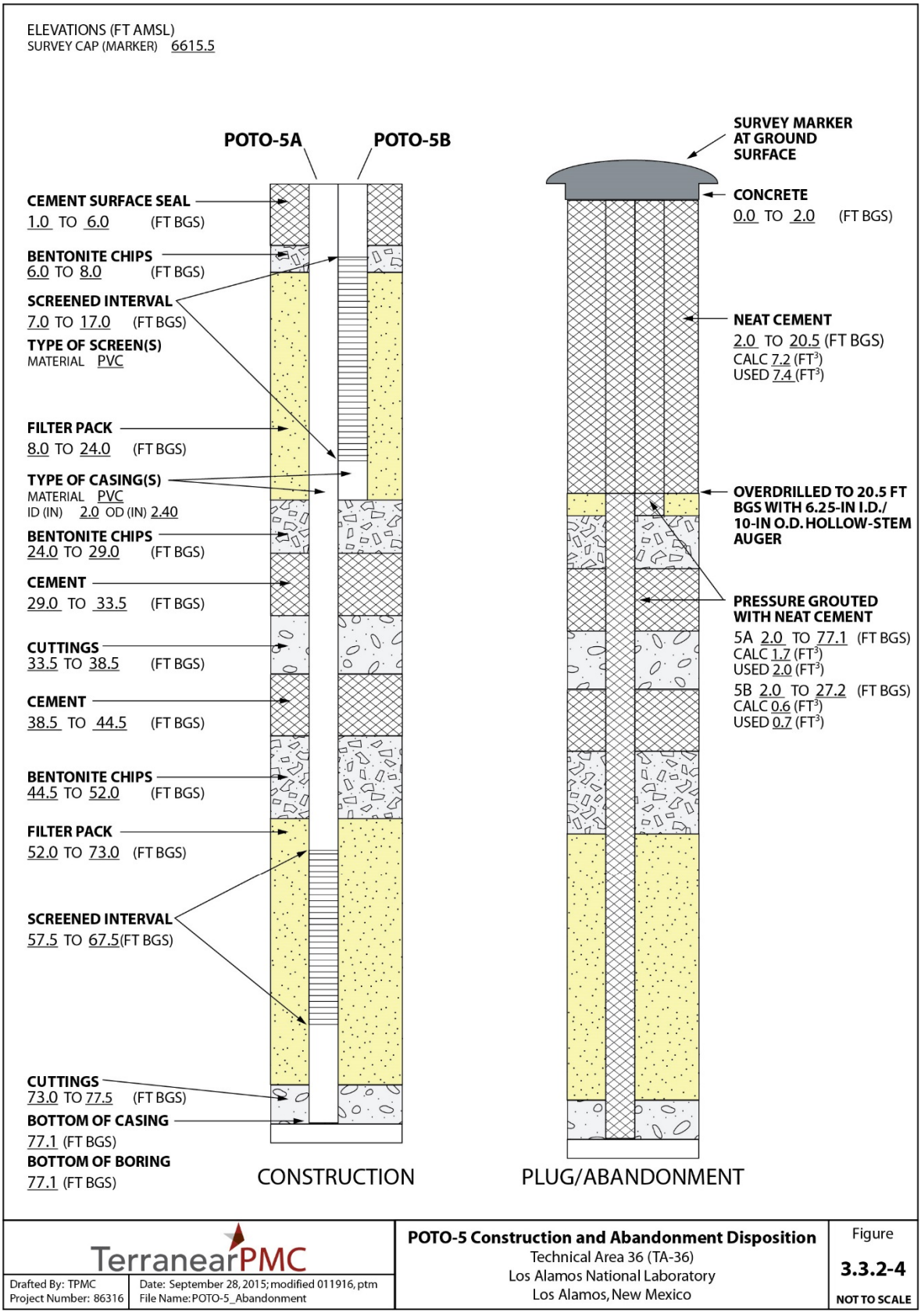

Figure 3.3-4 POTO-5A, B construction and abandonment disposition

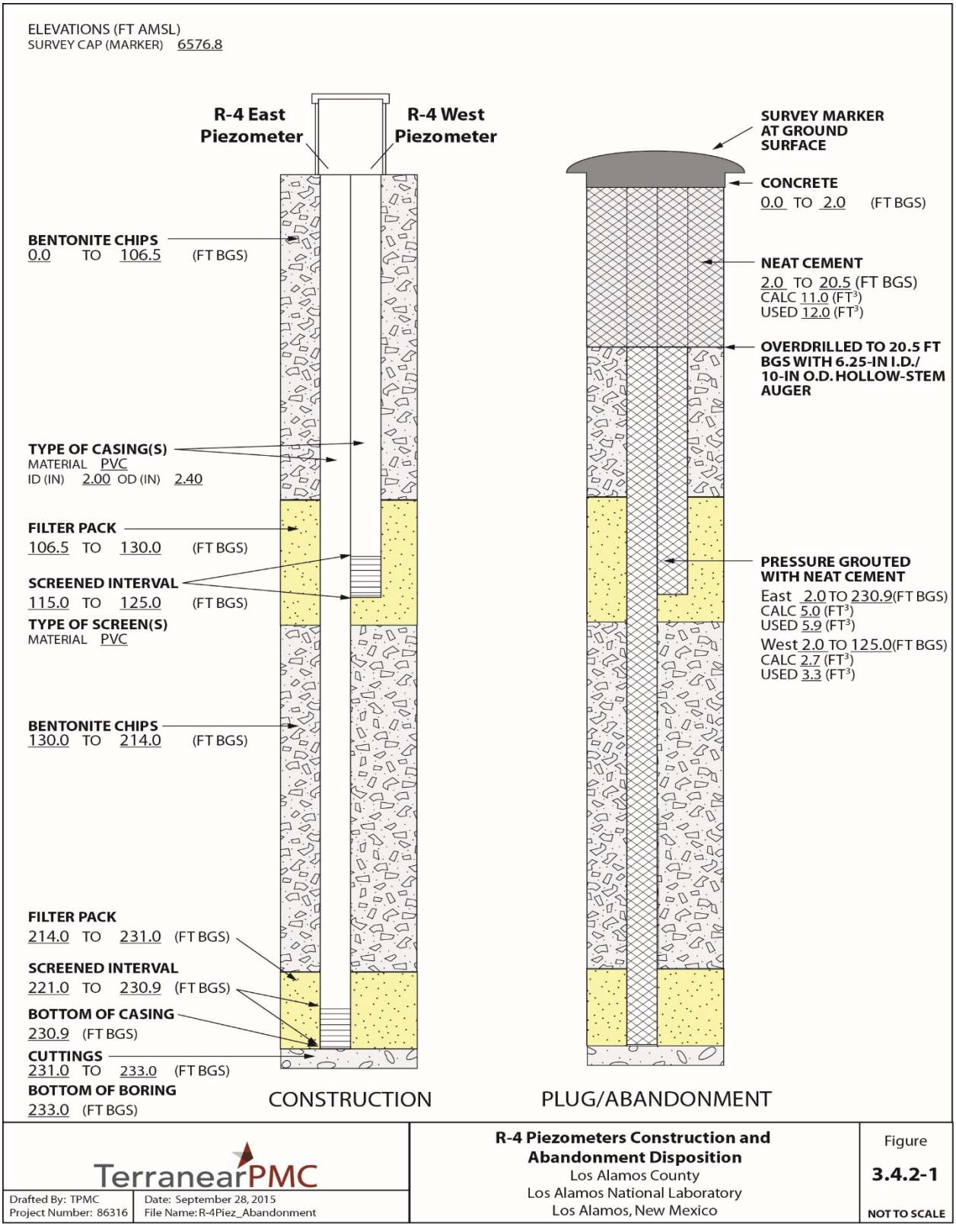

Figure 3.4-1 R-4 East and West piezometers construction and abandonment disposition

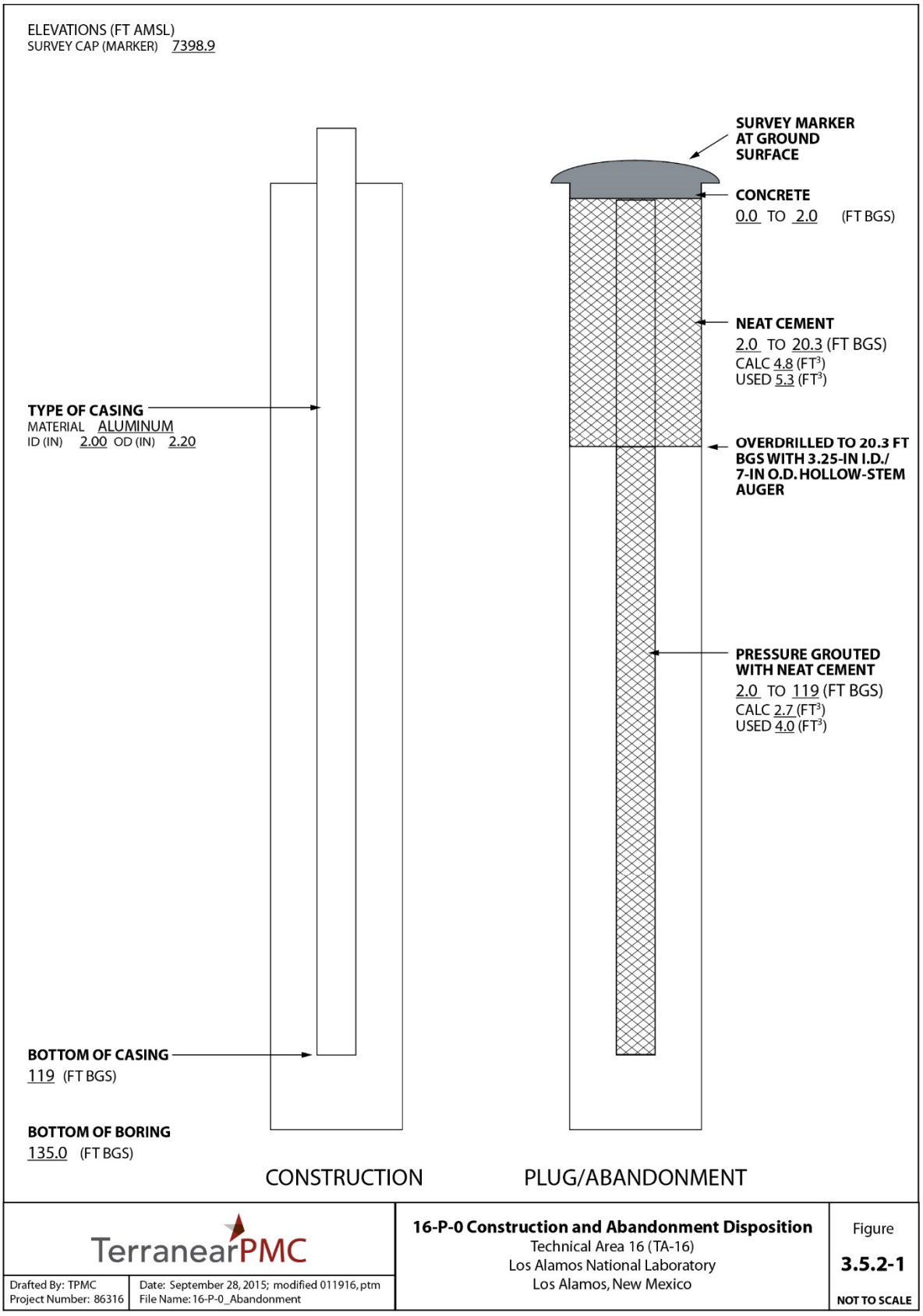

Figure 3.5-1 Borehole 16-P-0 construction and abandonment disposition

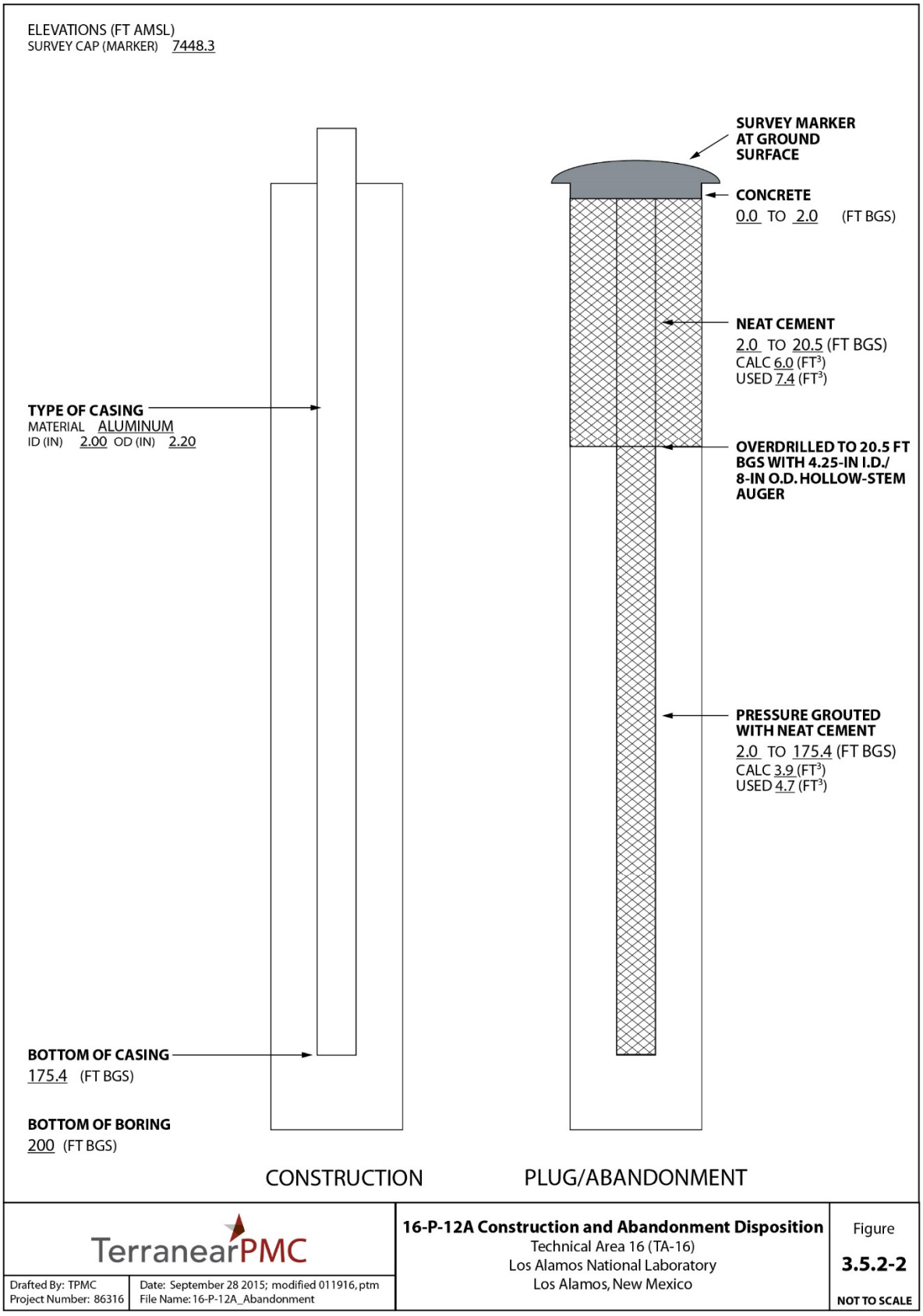

Figure 3.5-2 Borehole 16-P-12A construction and abandonment disposition

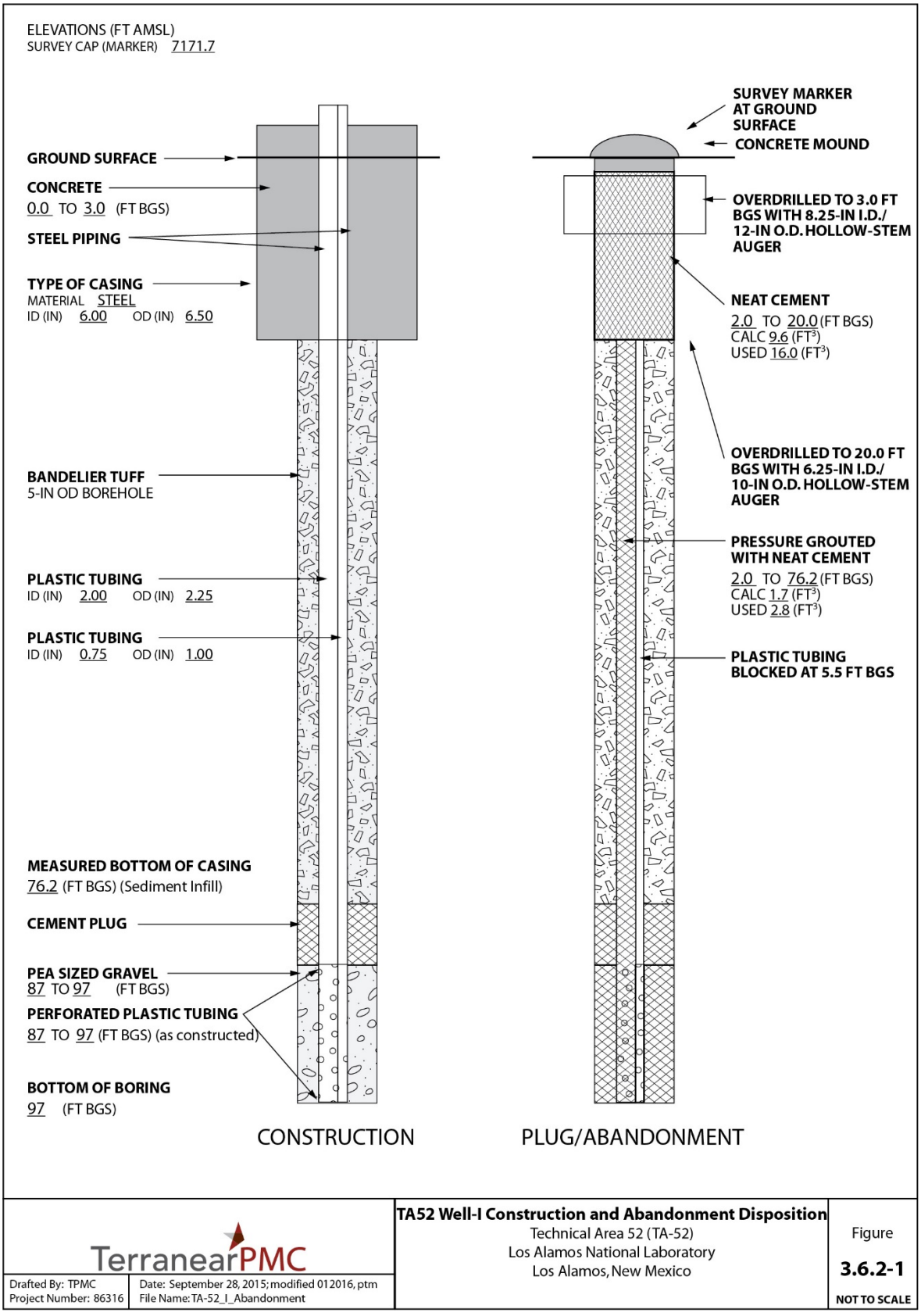

Figure 3.6-1 TA-52 Well-I construction and abandonment disposition

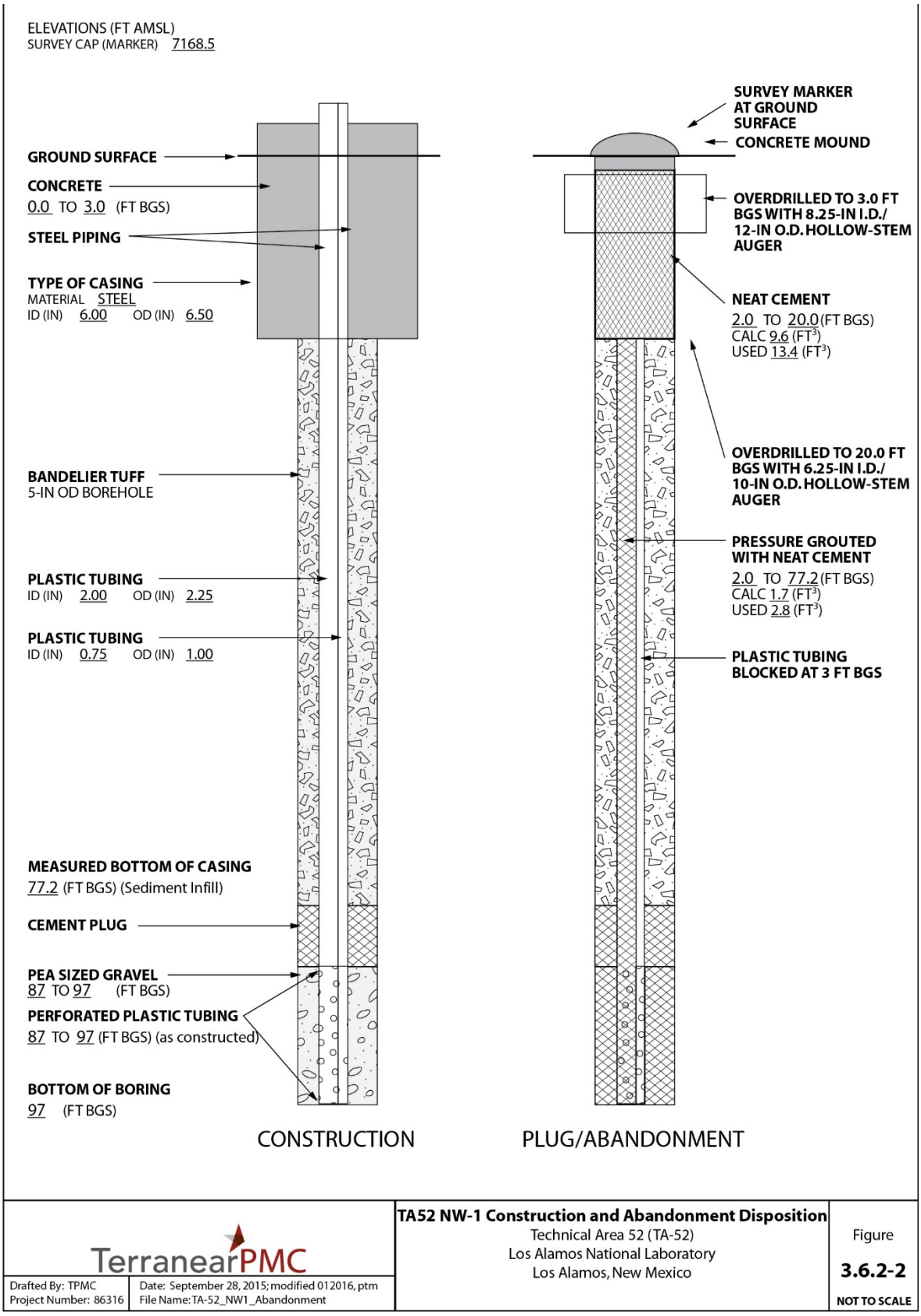

Figure 3.6-2 TA-52 Well NW-1 construction and abandonment disposition

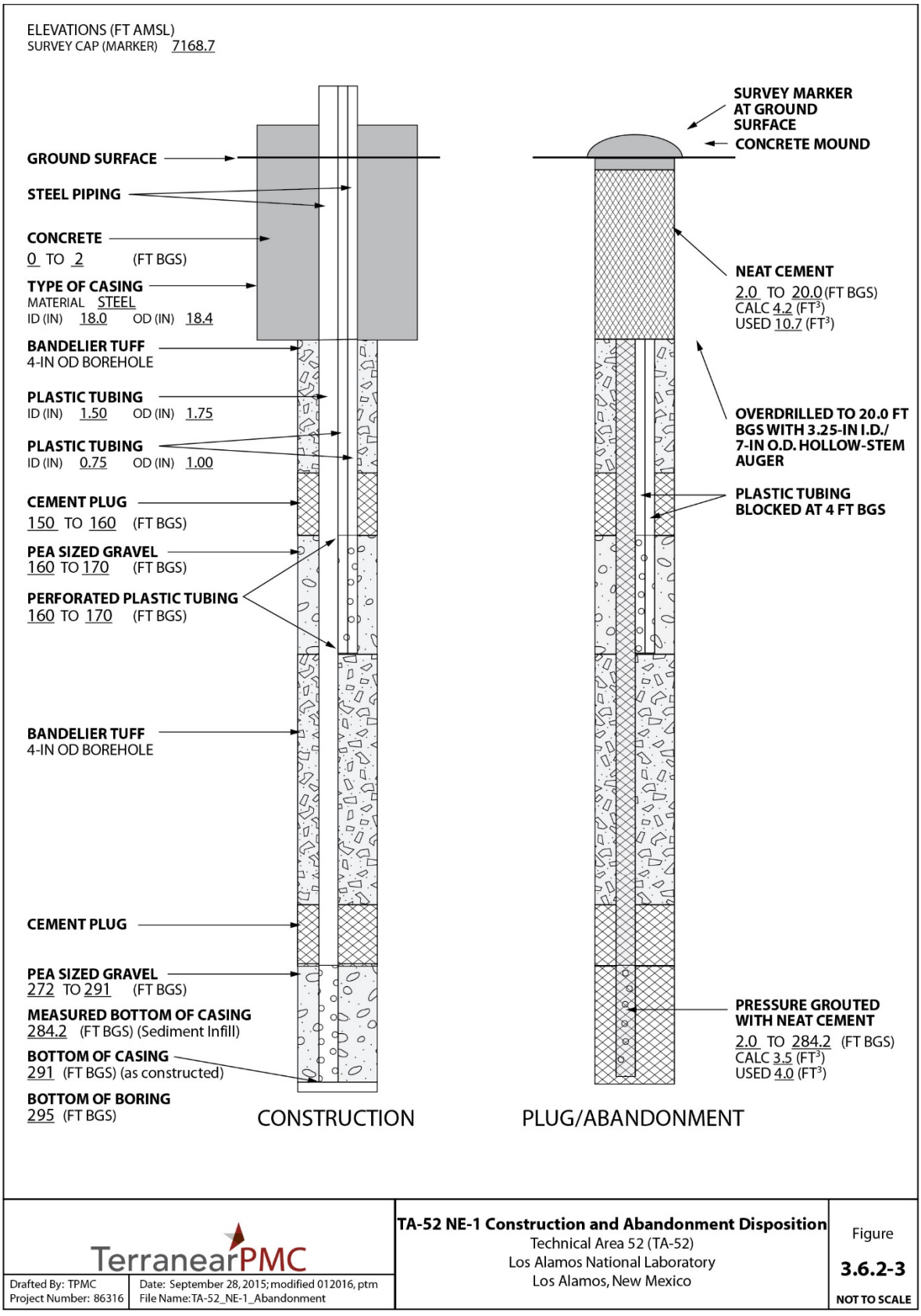

Figure 3.6-3 TA-52 Well NE-1 construction and abandonment disposition

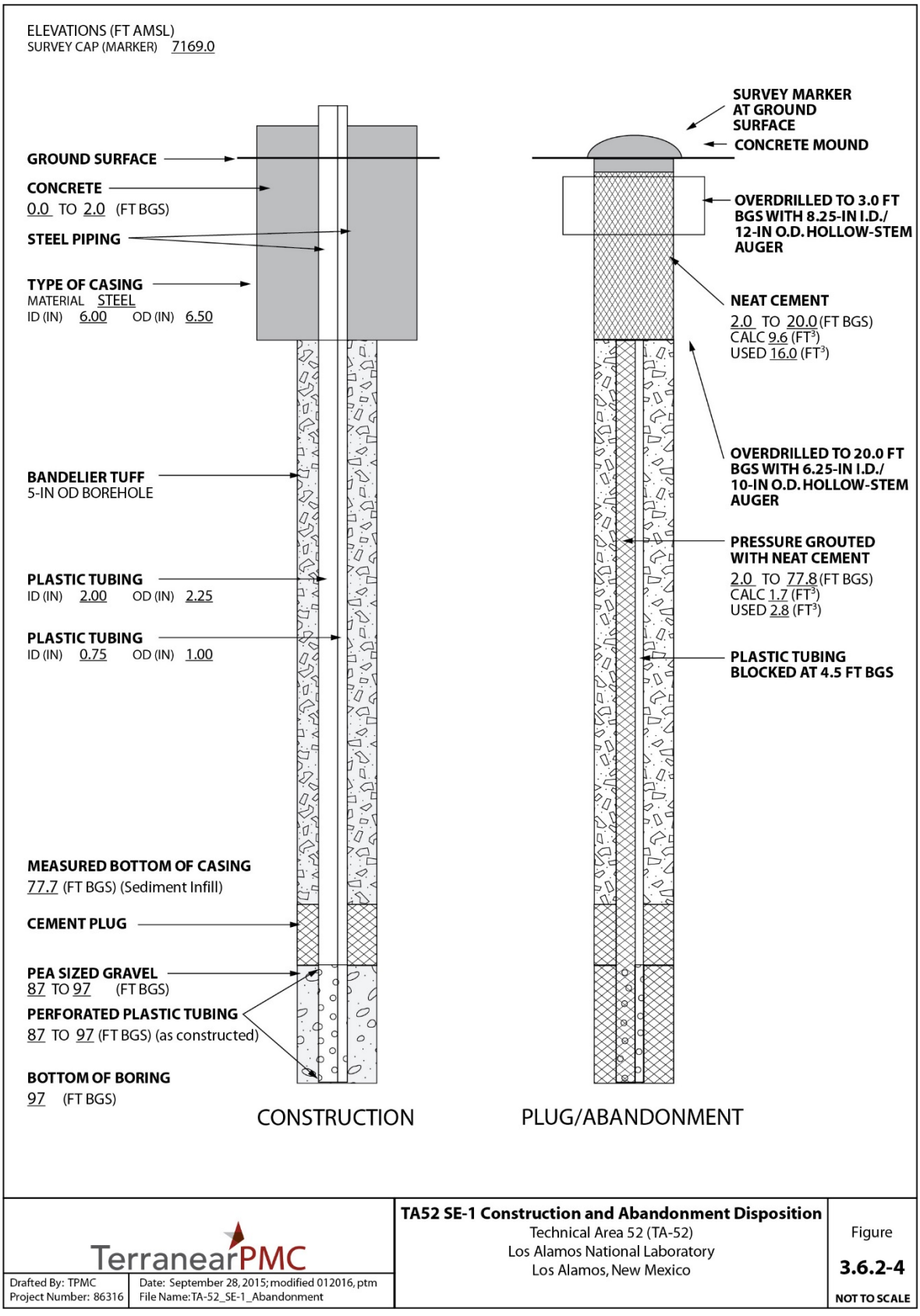

Figure 3.6-4 TA-52 Well SE-1 construction and abandonment disposition

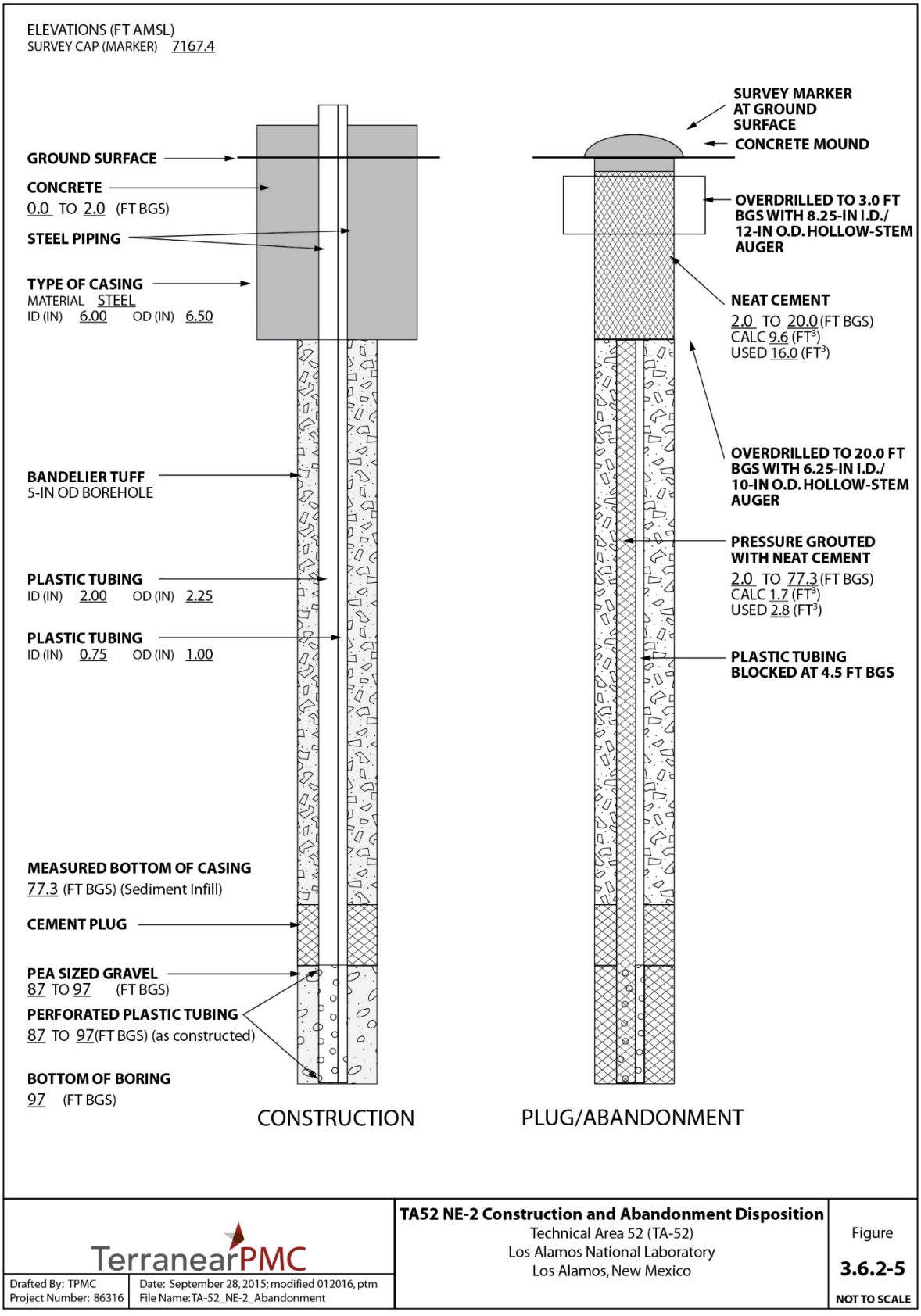

Figure 3.6-5 TA-52 Well NE-2 construction and abandonment disposition

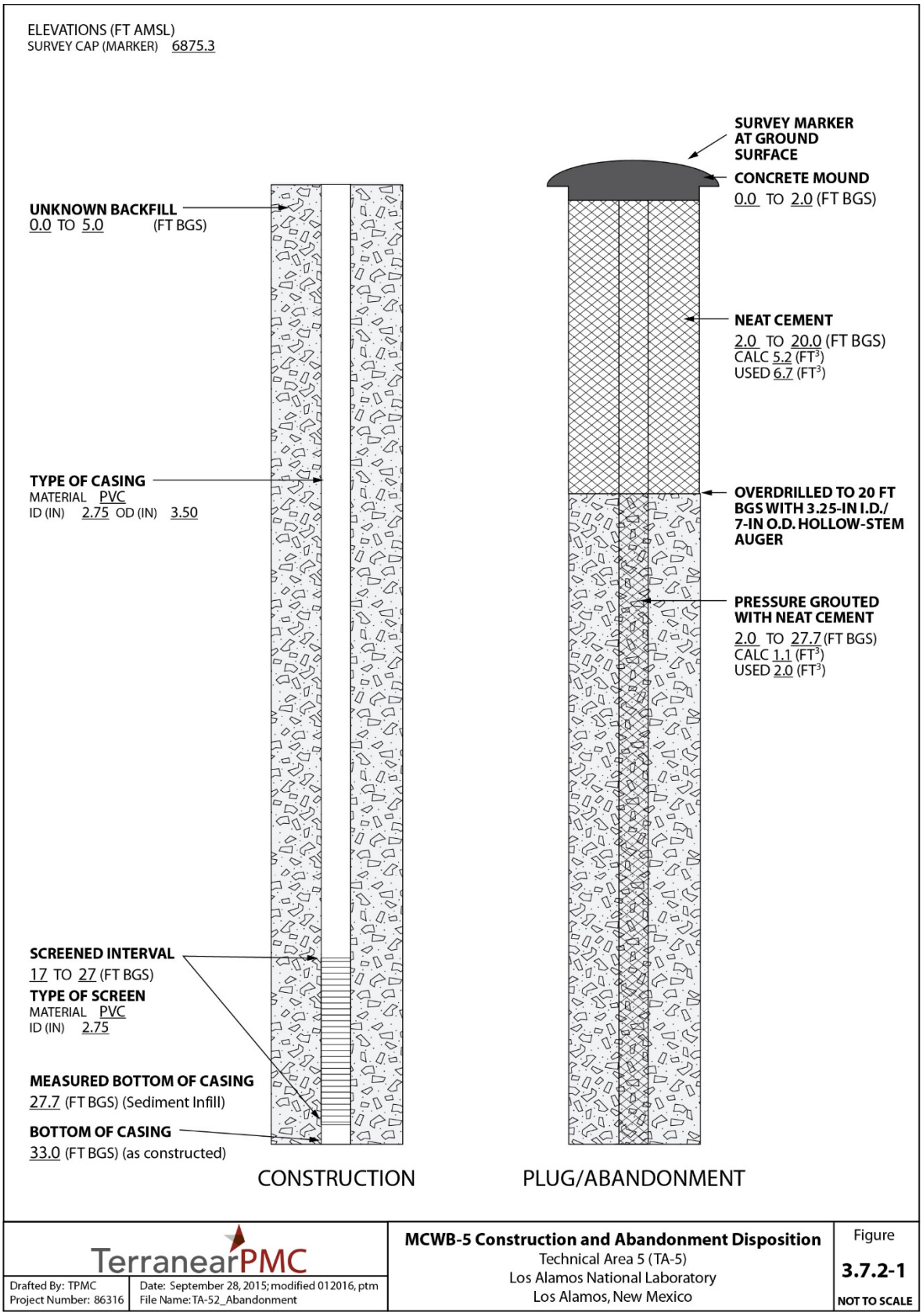

Figure 3.7-1 MCWB-5 well construction and abandonment disposition

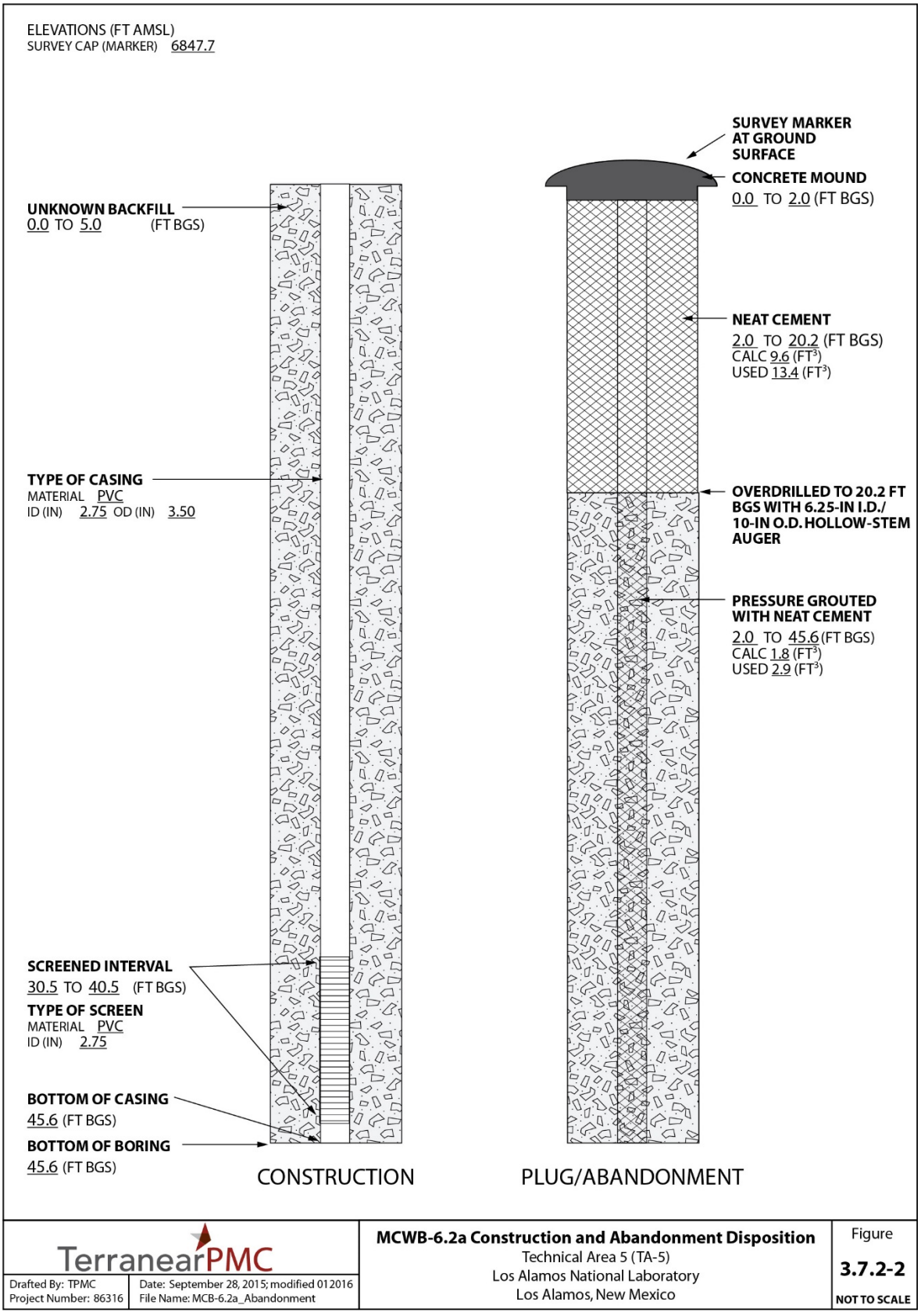

Figure 3.7-2 MCWB-6.2a construction and abandonment disposition

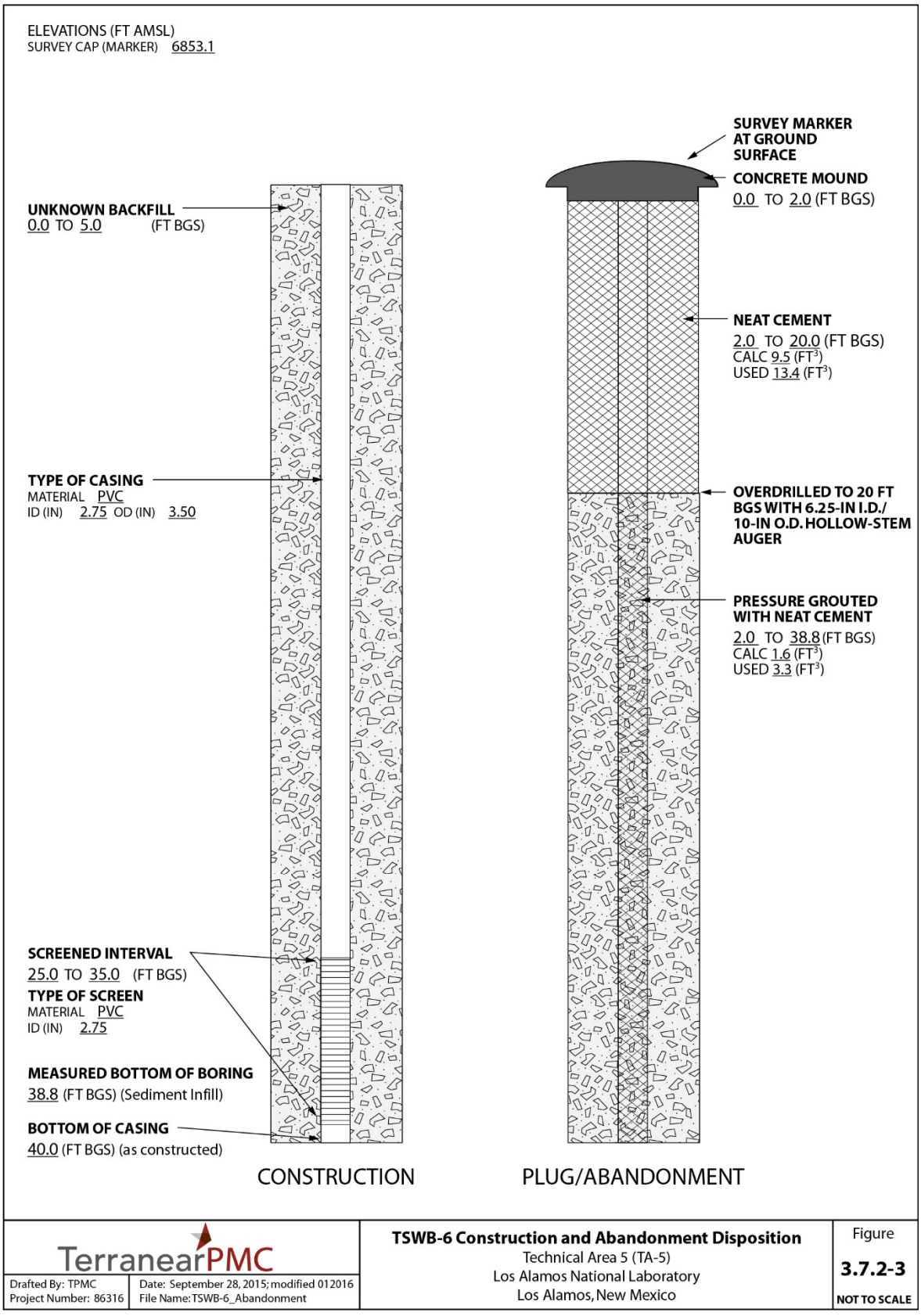

Figure 3.7-3 TSWB-6 construction and abandonment disposition

Table 3.1-1
Quantity of Neat Cement Grout Used to Plug and Abandon Wells in 2015

Well	Date Plugged	Volume of Portland Type I/II Cement to Plug Well Casing/Plastic Tubing			Volume of Portland Type I/II Cement to Plug Over-drilled Interval		
		Interval (ft)	Calculated Volume (ft^3)	Actual Volume (ft^3)	Interval (ft)	Calculated Volume (ft^3)	Actual Volume (ft^3)
16-P-0	7/23/15	2.0–119.0	2.7	4.0	2.0–20.3	4.8	5.3
16-P-12A	9/4/15	2.0–175.4	3.9	4.7	2.0–20.5	6.0	7.4
BCM-1	7/28/15	2.0–67.8	1.5	2.0	2.0–20.0	4.1	5.3
BCO-1	7/28/15	2.0–69.7	6.3	8.0	2.0–20.0	9.6	11.4
MCOI-1	9/3/15	2.0–825.6	4.5	4.7	2.0–20.5	6.0	7.4
MCWB-5	7/20/15	2.0–27.7	1.1	2.0	2.0–20.0	5.2	6.7
MCWB-6.2A	7/21/15	2.0–45.6	1.8	2.9	2.0–20.2	9.6	13.4
POTM-1	9/5/15	2.0–46.5	1.1	1.7	2.0–20.5	7.2	9.4
POTM-2	9/5/15	2.0–53.1	1.2	1.6	2.0–20.5	7.2	7.4
POTO-4A	9/5/15	2.0–47.2	1.1	1.2	Combined with values below		
POTO-4B	9/5/15	2.0–87.7	2.0	2.3			
POTO-4C	9/5/15	2.0–174.2	3.9	4.5	2.0–20.5	11.0	13.4
POTO-5A	9/5/15	2.0–77.1	1.7	2.0	Combined with values below		
POTO-5B	9/5/15	2.0–27.2	0.6	0.7	2.0–20.5	7.2	7.4
R4 East Piezometer	9/2/15	2.0–230.9	5.0	5.9	Combined with values below		
R4 West Piezometer	9/2/15	2.0–125.0	2.7	3.3	2.0–20.5	11.0	12.0
TA-52 I	7/22/15	2.0–76.2	1.7	2.8	2.0–20.0	9.6	16.0
TA-52 NE-1	7/22/15	2.0–284.2	3.5	4.0	2.0–20.0	4.2	10.7
TA-52 NE-2	7/22/15	2.0–77.3	1.7	2.8	2.0–20.0	9.6	16.0
TA-52 SE-1	7/22/15	2.0–77.7	1.7	2.8	2.0–20.0	9.6	16.0
TA-52 NW-1	7/21/15	2.0–77.2	1.7	2.8	2.0–20.0	9.6	13.4
TSWB-6	7/21/15	2.0–38.8	1.6	3.3	2.0–20.0	9.5	13.4

Table 4.0-1
Survey Coordinates of Aluminum Pin Embedded in Concrete Plug

Well Identification	Northing	Easting	Elevation
16-P-0	1763584.287	1616459.399	7398.936
16-P-12A	1764076.658	1616900.389	7448.313
BCM-1	1778914.149	1640658.884	6641.825
BCO-1	1778915.961	1640649.415	6642.295
MCOI-1	1769956.568	1628046.120	7108.142
MCWB-5	1769484.011	1632576.529	6875.318
MCWB-6.2A	1768967.860	1633752.812	6847.691
POTM-1	1757302.965	1637636.415	6636.398
POTM-2	1757119.565	1638907.630	6616.576
POTO-4A,B,C	1757056.953	1638939.305	6615.605
POTO-5A,B	1757050.902	1638945.987	6615.500
R4 Piezometer	1776517.093	1639297.733	6576.783
TA-52 I	1768242.618	1629060.345	7171.716
TA-52 NE-1	1768205.599	1629056.249	7168.704
TA-52 NE-2	1768180.955	1629054.546	7167.390
TA-52 SE-1	1768200.691	1629041.992	7169.012
TA-52 NW-1	1768198.532	1629046.611	7168.530
TSWB-6	1768489.709	1633382.200	6853.095

Note: All coordinates are expressed as New Mexico State Plane Coordinate System Central Zone (NAD 83); elevation is expressed in feet amsl using the National Geodetic Vertical Datum of 1929.

Appendix A

Video Logs of Wells BCM-1, BCO-1, 16-P-0 and 16-P-12A
(on DVDs included with this document)

Appendix B

New Mexico Office of the State Engineer
Plugging Plans of Operation and Plugging Records
(on CD included with this document)